Archaeobotany at Gabii:
an investigation of macro plant remains in 6th century BCE central Italy

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ABSTRACT

This paper is a consideration of carbonised carpological remains of mixed tertiary deposits from early Iron Age central Italy. The site in question is an elite stone settlement from Area D in the Latin city of Gabii. Twenty floatation sediment samples taken from Room 1, Room 2 and open areas of the complex were weighed, sieved and sorted for macro-remains. Carbon remains were set aside for future analysis and carpological remains were identified using an array of reference atlases, consultation and scholarship articles. Seeds and fragments were counted and considered in terms of formation processes and composition. While the formation process of the indoor deposits was the same, a significant difference in density, diversity and preservation was found in the open areas of the complex suggesting they stem from separate refuse sources and represent different assorted activities. In terms of composition, the deposits were found to be mostly rich in staple crops with little chaff and weeds present. It appears that the initial crop processing stages occurred elsewhere, attesting to an abundant availability of labour. The plant assemblage represents a range of crops typical of archaeobotanical studies from contemporary sites in the area with certain variations occurring due to cultural preferences. The plants of these deposits showed a limited range of crops usually associated with low status foods despite the wealth of the complex thus casting doubt on the concepts of “high” and “low” status crops. With archaeobotanical identification still pending in several areas of the complex, no definitive conclusions have been made on the exact location of initial processing, therefore a synchronisation of data will be needed in the future.

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Chapter I: Introduction

1.1 THE DISCIPLINE OF ARCHAEOBOTANY

Archaeobotany, or Palaeoethnobotany as it is known in North America, is a sub-discipline of archaeology which focuses on the recovery, identification and analysis of archaeological plant remains for the purpose of understanding past human-environment relationships. It covers a wide range of contexts from the investigation of subsistence strategies to funerary practices and any archaeological context which includes the survival of plant remains.

Archaeobotany began, as sub-disciplines in the archaeological field often do, as an avocation of scientists. In Italy, the first recorded interest in archaeological plants occurred in the mid-18th century with an exhibition held in Portici of remains collected during the excavations at Pompeii and Herculaneum (Mariotti Lippi et al, 2018). The first scientific studies are attributed to the late 19th century when Oswald Heer recorded plant remains from Swiss lake villages (Lodwick, 2019). Other contemporary studies involved the recovery of plant remains from Roman Silchester and Glastonbury Lake village in England by Reid and Lyell (Lodwick, 2016)[1], and the recording of desiccated flora in Egyptian tombs by Schweinfurth (Mercuri et al, 2018)[2]. At this point, archaeobotany was not considered a field of study but rather a collector's hobby. With no systematic sampling, evidence was recorded mostly on a descriptive basis and recovery only occurred in what were considered exceptional circumstances.

In his article '*Advances in archaeobotanical method and theory: charting trajectories to domestication, lost crops, and the organization of agricultural labour*' (2009), Fuller references three distinct phases of archaeobotany: an external consultant phase, a specialist stage, and a specialist-archaeologist stage. The first phase was from the late 19th to early 20th century as described above.

The specialist stage in archaeobotany occurred in the mid-20th century when the discipline was honed to a more professional level. Coinciding with the emergence of Processualism or 'New Archaeology', scientists assumed a more dynamic approach to the recovery and interpretation of samples. Systematic sampling began and botanical data was integrated with archaeological research questions. Use was made of ethnographic models (Fuller, 2009), experimental charring (S. Boardman & Jones, 1990) and statistical analysis (Lodwick, 2019). The 1970s saw the introduction of habitual flotation[3] and sieving in agricultural studies and a diversification in the investigation of taphonomic processes[4] which allowed for abundant sampling resulting in much more significant data patterns (Lodwick, 2019). This set the course for the third phase of specialist-archaeologist archaeobotany.

[1] Study conducted 1889 to 1909

[2] Study conducted 1884

[3] First flotation occurred on-site in Low.-Il.-Va, Illinois, USA (Struever, 1968)

[4] Consider Francis J Green article '*Phosphatic mineralization of seeds from archaeological sites*' (1979)

With the groundwork laid, archaeobotany has matured as a discipline. Research questions continue to grow in sophistication with more thought being given to site formation processes and reflection on anthropogenic involvement (Fuller, 2009). The 2000s brought more archaeological engagement and the continued expansion of techniques, materials, and geographic regions. Subsequently, archaeobotany has continued its expansion into the sciences by incorporating increasing archaeometric techniques from stable isotope analyses (Fiorentino et al, 2014) to research on ancient plant DNA (Schlumbaum et al, 2007) and morphometrics (Portillo et al, 2019). Further diversification of material has encouraged a growth in the study of micro-remains such as phytoliths, diatoms, starch, and pollen analysis (Neumann et al, 2016).

Moving forward there remains the question of direction. It is often cited that archaeobotany requires better engagement with the general public and even within the field there is a need for more effective data synthesis (Lodwick 2019). There is clear room for improvement in recovery techniques[5], however established methods of extraction continue to be refined as technologies improve and more consideration is given to pre- and post- depositional conditions (VanDerwarker et al, 2015). The birth of the internet has facilitated the diffusion of information, online databases and archives, and tutorial videos (Lodwick, 2019). Journals and communities such as the International Workgroup for Palaeoethnobotany (IWGP) that were established in the last century continue to grow as research expands into new geographical regions and archaeological periods.

1.2 THE PRESERVATION OF MACRO PLANT REMAINS

It is a fact commonly stated that the accuracy of archaeobotanical studies is only as good as the quality of the remains and recovery thereof (van der Veen, 2007). Due to the delicate nature of plant material, there are a limited number of preservation methods each of which occur in very particular circumstances. Archaeobotanical remains exist in various states of fragility and thus require different recovery methods which will be remarked on along with the taphonomic processes most relevant to the preservation of macro remains below.

1. <u>Waterlogging</u>

One of the most common archaeobotanical contexts for macro remains in temperate climates, waterlogging occurs in deposits accumulated under groundwater. For optimal preservation conditions must be anaerobic with low temperatures; applicable sites include cesspits, wells, ditches, bogs and lakeside dwellings. Materials preserved by waterlogging will typically be unchanged with a high density and quality of preservation. Unlike other, harsher, taphonomic processes, waterlogged materials can support more fragile plant tissue and as a result will often contain a wide variety of taxa (Jacomet, 2013). Waterlogged samples are most commonly extracted

[5] e.g. there are still limits to which soils can be processed with flotation. Seeds, especially small ones, are often lost and larger ones are fragmented.

through wet-sieving or wet screening[6] and must be stored in water to prevent disintegration (White and Shelton, 2014).

2. Mineralisation

A step further from waterlogging, mineralisation is highly dependent on aerobic soil conditions and only occurs when macro-remains are deposited in calcium-rich waters. Materials maintain their shape and even occasionally surface ornamentation, however the minerals replace their biodegradable structure and render them inorganic. Depending on the level of mineralisation, the samples may maintain certain aspects of their organic structure or may experience complete cellular replacement. In his article, Green (1979) described mineralised seeds as lightweight, 'honey-brown' in colour with low quality crystalline structures. The most common contexts are faecal deposits and extraction occurs by disaggregating the soil then sieving. Although mineralised seeds are much tougher than waterlogged ones, they too are vulnerable to disintegration if exposed (Green, 1979).

3. Desiccation

These materials are preserved under dry conditions and stem from varied contexts.[7] Desiccated assemblages do not undergo alteration but will preserve their shape, size and colour. Due to the high quality of preservation, desiccated plants will commonly occur in high density with a broad range of taxa, plant parts and remarkably detailed features. The materials are more durable than waterlogged or carbonised deposits and are therefore capable of surviving recurring deposition (van der Veen, 2007). Desiccated samples are usually extracted from sediment by dry sieving (White and Shelton, 2014).

4. Carbonisation

Carbonisation is the preservation of plant material through charring and is the most common form of macro remain preservation. It is also the process dealt with in this thesis. Sites with charred assemblages are pervasive, however samples recovered are often low yield and fragile. Since the remains need to be burned to survive, carbonisation yields a very specific selection of plant material (cereal grain, cereal chaff, pulses, nuts and wild seeds) and will only entail a broader range of taxa in exceptional cases of wide scale fires. The usual charred material, as noted above, are by-products of cereal harvests which are thought to be repurposed as fuel during crop processing (van der Veen 2007). Charred seeds will be black in appearance and often distorted to a level dependent on the conditions of carbonisation (Boardman and Jones, 1990)

Due to its ubiquity the formation processes of carbonisation have been extensively studied and forms of entry have been refined to the following five methods: use as intentional or 'casual' fuel; accidents during food preparation; hostile or accidental fires; intentional clearing of a storage pit; destruction of a diseased or infested crop (van der Veen, 2007).

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[6] Wet-sieving involves the submergence of sediment into water whereas wet-screening is conducted by lightly rinsing samples with no full submersion. Another option is the 'wash-over' technique which involves the repeated decanting of water aggregated sediment through sieves (White and Shelton, 2014).

[7] van der Veen (2007) cites studies conducted on the following contexts: pit falls, middens, hearths, dung, wall plaster, mudbrick and timber framed houses.

Carbonised material is currently recovered through flotation, following which remains are extracted from the sediment through dry-sieving. This method will be covered in chapter three.

1.3 CARPOLOGY

Carpology is a modern botanical term for the study of fruits and seeds. It also exists as a subdivision in archaeobotany where it has acted as a driving force behind our understanding of past agricultural practices and food cultures. Application differs slightly between modern and archaeobotanical carpology due to limitations of the archaeological record (Neef et al., 2012), however archaeobotanical methods are well established and continue to develop as more techniques are introduced to the field (Portillo, 2019).

The core purpose of archaeobotanical carpology is the identification of seeds and fruits based on specific diagnostic characteristics. This requires a concise knowledge of the various classifications of plant taxa and an understanding of the nomenclature which will be covered below.

The first division in botany is in the grouping of plants into families. Countless plant families have been identified to date, however, there tends to be a recurring pattern of families recovered from archaeobotanical sites which can be seen in *Figure 1*. Following this, plants, as all living things, are further organised into genus then species and subspecies according to common characteristics. These classifications are determined by seed dispersal methods or reproductive plant parts.

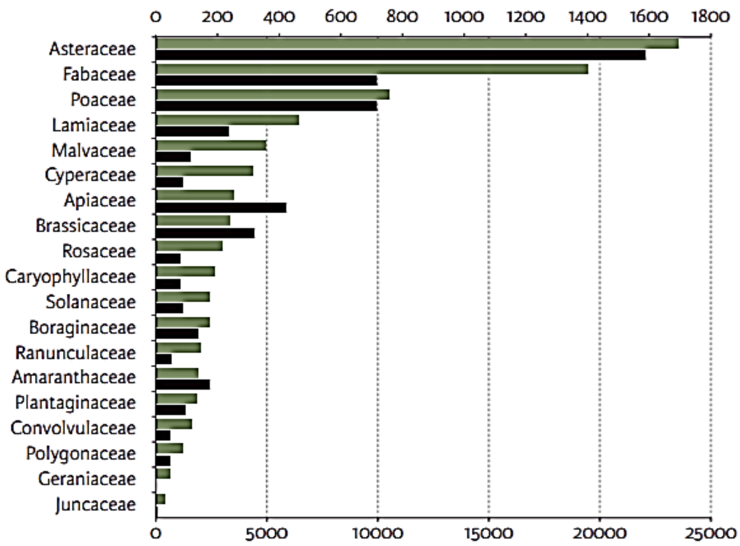


Figure 1: Absolute number of genera (brown, count on top axis) and species (green, count on bottom axis) counted thus far in archaeobotanical assemblages (Cappers and Bekker, 2013)

Morphology and generative methods vary greatly in the plant kingdom, and characteristics may occur in more than one family. For this reason, one must take into consideration a multitude of features in combination. The most important characteristics are how a plant develops; how the flowers and subsequently the fruit are connected to the plant; and what portion of the plant carries out seed dispersal.

Inflorescence and Infructescence

The different organisations of one or several flowers around the stem of a plant is known as inflorescence. Infructescence refers to the arrangement of fruit around the stem of a plant. Due to the frailty of archaeobotanical remains, it is rare for plants to occur in these formations, however, an understanding of inflorescence and infructescence is a useful tool in recognising fragmented plant parts and understanding the overall context and functionality of remains.

Seeds and Fruits

The second diagnostic feature of family, plant propagation, is conducted by the diaspore, a unit consisting of either a seed, a fruit, or an amalgamation of a fruit and parts of a flower.

The seed is the matured ovule holding the embryonic offspring. It is always present in a dispersal unit. In gymnosperms, the seed is found naked and enclosed by a cone (*e.g.* Pines, P*inus* sp.). In angiosperms the seed is encased by the fruit, a ripened ovary of a pollinated flower. This enclosure may occur in several different ways from the seed being amalgamated to the fruit (eg. Sunflowers, *Helianthus annuus*); in the form of a stone with three distinct layers (*e.g.* Olives, *Olea europea*); or completely disconnected (*e.g.* Melon, *Cucumis melo*).

In the case of agricultural research, one of the most studied plant groups is the Poaceae family. This family consists of a broad range of species from crops to weeds. Most significant, are the selection of crop plants which are integral to human agriculture. Poaceae plants are the third example of a diaspore: a fruit which is still connected to parts of the flower. Poaceae flowers will produce a single fruit as a diaspore. This fruit is wrapped in bracts, a leafy structure made up of separate layers of chaff which connect it to the plant (Jacomet, 2006). This family will feature most heavily in the results of chapter four where all the relevant families will be discussed.

Chapter II: Setting the Scene

2.1 THE CITY OF GABII

The ancient city of Gabii is located 18 km east of Rome along modern day Via Prenestina. It is a large settlement, estimated from surveys to have spanned more than 65 hectares (Mogetta and Becker, 2014). The morphology of the city follows the topography of the land, curving along the southern slope of the now extinct volcanic crater of Castiglione and descending to the South towards the Patano Borghese depression.

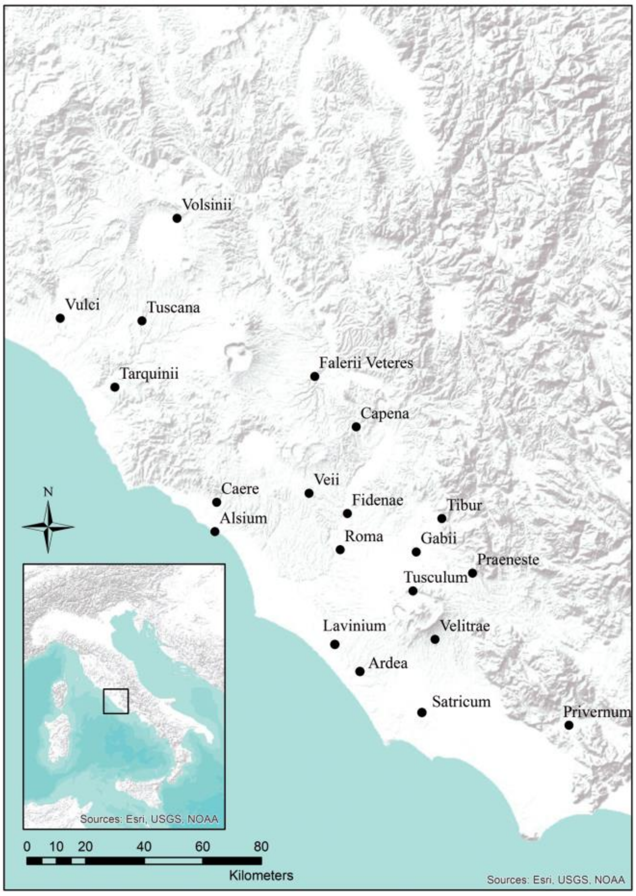


Figure 2: Map of Central Italy marking Gabii and other relevant 1st millennium settlements from 2019 Gabii Field Report (Evans et al, 2019)

The city originated from a dispersed settlement around the 8th century BCE. By the Republican era, it had grown into one of the principal cities of central Italy (Evans et al, 2019). Occupation evidence varies through time and space, from huts to elite residences, from public buildings to industrial sites and quarrying mines until its eventual abandonment by the mid-Imperial period[8] (Evans, 2008).

Republican Gabii's central axis is a regional road connecting it to other contemporary settlements including Rome. This road is suspected to be what ancient sources referred to as *via gabina* (Mogetta and Becker, 2014). The rest of the city was constructed in uniform gridded blocks oriented around this 5th century BCE thoroughfare.

[8] Evidence suggests final occupation phase occurred around the 4th or 5th century CE (Evans et al, 2019).

Gabii is a point of fascination for many scholars as it presents the unique opportunity of studying urban development at a pivotal moment in central Italian history (Becker et al, 2009). The first millennium BCE denotes a period of urbanisation on the Italian peninsula as populations nucleated, technologies evolved, and social hierarchies emerged (Motta and Beydler, forthcoming). In 2009, with limited evidence available on urbanisation processes at the time, Gabii was recognised for what it was: a wide-scale, populous city with potentially archaeologically legible development and little disturbance post-abandonment (Becker et al, 2009).

2.2 THE GABII PROJECT

It is from these observations and the field surveys previously conducted (Guaitoli, 1981), that the Gabii Project was born. The Gabii Project (GPR) is an ongoing collaborative effort of the University of Michigan and the Soprintendenza Speciale Archeologia Belle Arti e Paesaggio di Roma (SS-ABAP-RM). The project began in 2007 with the intent to investigate urban evolution in central Italy. Following two seasons of magnetic survey and boreholes which revealed promising stratigraphy and the first hints of an orthogonal city plan, excavations broke ground in 2009 (Becker et al, 2009).

The excavation zones were determined according to the pre-existing orthogonal grid of the city and labelled Areas A through J. Excavation priorities were determined according to the preliminary coring results which showed significant damage to the stratigraphy from modern ploughing in the southern part of the city (Becker et al, 2009). Thus, to begin Areas A through D were selected for excavation and this would continue to expand into Areas E through J in the following years.

Figure 3: 2018 Excavation plan of Gabii (Evans et al, 2019)

Recent excavations have occured in Area F where a single three terrace complex of 2000 m² dominates the entire block. This mid-Republican structure was excavated between 2012 and 2015 and is thought to have served as a public building in the published report (Johnston et al, 2018). With this concluded, the remaining Areas E and G through I are pending publication.

Area A occupies the northernmost sector of the city, closest to the Castiglione crater. The land is shallow and characterised by several rock cut features, including two burials from the orientalising period and the remains of a structure dated between the third and second century BCE, however, this area underwent significant destruction when it was repurposed as a quarry during the Imperial era (Mogetta and Becker, 2014). As a result, it offers challenging archaeological legibility and a generally low yield of archaeological and archaeobotanical remains (Motta, 2016). However, the archaeobotanical remains which have been recovered from Area A span from the Archaic period to the Imperial period (publication forthcoming).

Area B is found to the south of Area A and is occupied mostly by a Republican residence, the Tincu House which has been fully published (Opitz et al, 2016). It also served as a burial ground during the imperial era. The area sustained significant damage due to its proximity to the Area A quarry. Although the stratigraphy and constructions are comparatively better preserved.

From the Iron Age until the site's eventual abandonment, Area C went through significant changes. Evidence of a 7th century BCE hut and contemporary infant burials have been uncovered here, following which, a large domus aligned with the city's grid system was constructed over the area. Overall, the area was residential until the late 2nd century BCE at which point it was abandoned, levelled and transformed into a three-building industrial complex (Mogetta and Becker, 2014).[9] The 2016 discovery of a wall may denote the continuation of a 6th century BCE domestic complex located to the east of this zone in Area D. The investigation of Area C is ongoing (Evans et al, 2019).

AREA D

Particular attention needs to be given to Area D of the GPR as it is remains from this city block which have been selected for this thesis. Area D is thought to show the earliest signs of Gabii's occupation. Located in the eastern part of the city, Area D contains the oldest excavated structures of the settlement. The block measures approximately 45 x 20 metres and is framed to the East by a branch of the city road plan[10]. The land remains unexplored in all other directions and is delineated by excavation limits. Similar to the rest of Gabii, construction of the area adheres to the slope of the crater. Overall, the bedrock is extremely close to the surface, however, it is increasingly buried under a silt deposit as the slope declines southwards. The sediment at its deepest was approximately 0.8 metres and likely contributed to preservation of the structures only found in the southern three-quarters of the area (Mogetta and Becker, 2014).

While the GPR has explored several areas since its launch, excavations between 2012 and 2015 focused heavily on Area D as attention was given to the origins of the settlement (Evans et al, 2019). Occupation in Area D began as a multi-hut complex in the middle of the 8th century BCE[11]. In the following century, these huts unified into a single compound which subsequently, in the late 7th or early 6th century BCE, would give way to the construction of a single stone complex.

This stone complex is thought to have been an elite social compound (Mogetta and Becker, 2014). Several infant burials have been discovered in conjecture with this phase, three of which contained artefacts indicative of a wealthy household (Evans et al, 2019). Additionally, the recent field report revealed a wall surrounding the compound. While this perimeter is not entirely excavated, it is suspected to cover a land base of 20 x 30 metres as shown in Figure 4 (Evans et al, 2019).

[9] Evidence of drainage, pigments and mortar fragments suggest dyeing activities. Floor imprints also show distinct signs of a storage facility (Mogetta and Becker, 2014).

[10] Area C is located across this side road.

[11] The area was dominated by one large oval hut with two circular satellite ones and assorted other features. The buildings were constructed of wattle and daub with sunken floors and thatched roofs. See Figure 5 for visual reference (Evans et al, 2019)

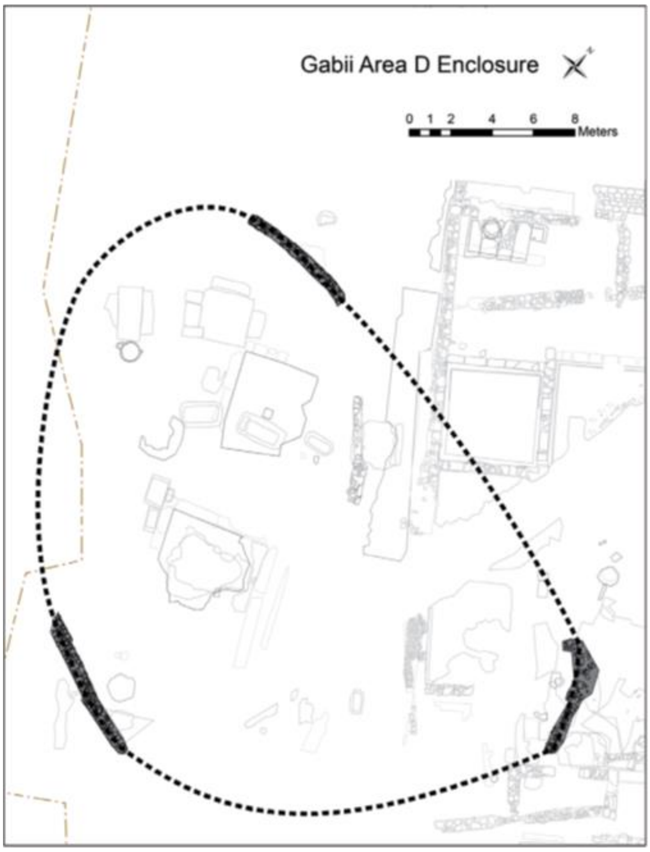


Figure 4: Presumed wall limits of the Area D stone compound (Evans et al, 2019)

This complex remained in use until its abandonment in the late 6th or early 5th century BCE upon which the land was briefly used as a burial ground[12] (Mogetta and Becker, 2014). Activity in the area ceases following the construction of the road in the 5th century BCE. Though the orthogonal grid incorporated the structures in Area D, no activity occurred following its application with the exception of the truncation of the parallel road during the construction of a domus in Area C. The disturbance to the area itself during construction was, however, minimal (Evans et al, 2019).

[12] Three rock-cut tombs with repeat depositions were found along the perimeter of the structure. It has been theorised due to their proximity to the complex that it was likely still visible at the time of construction (Mogetta and Becker, 2014).

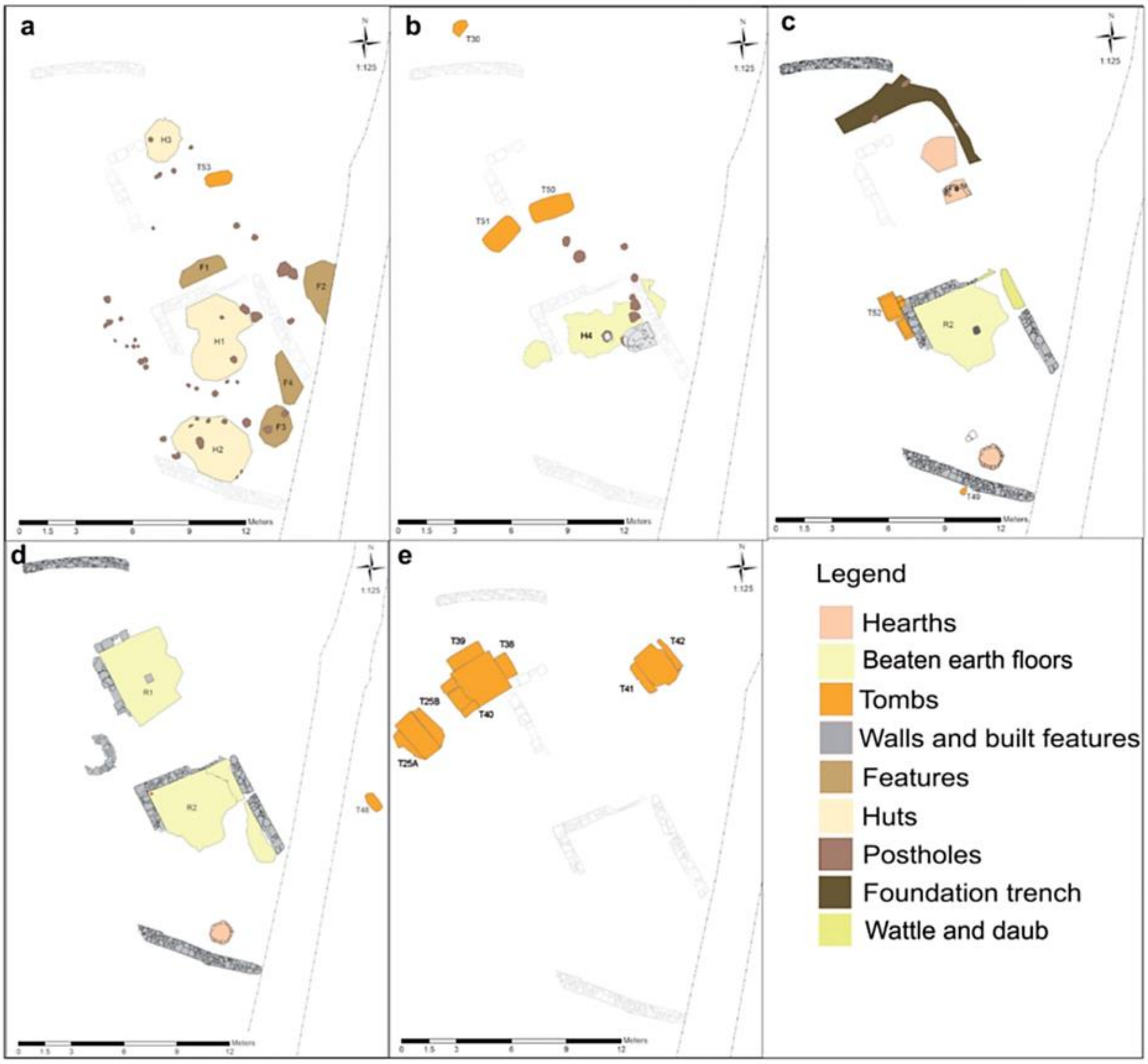
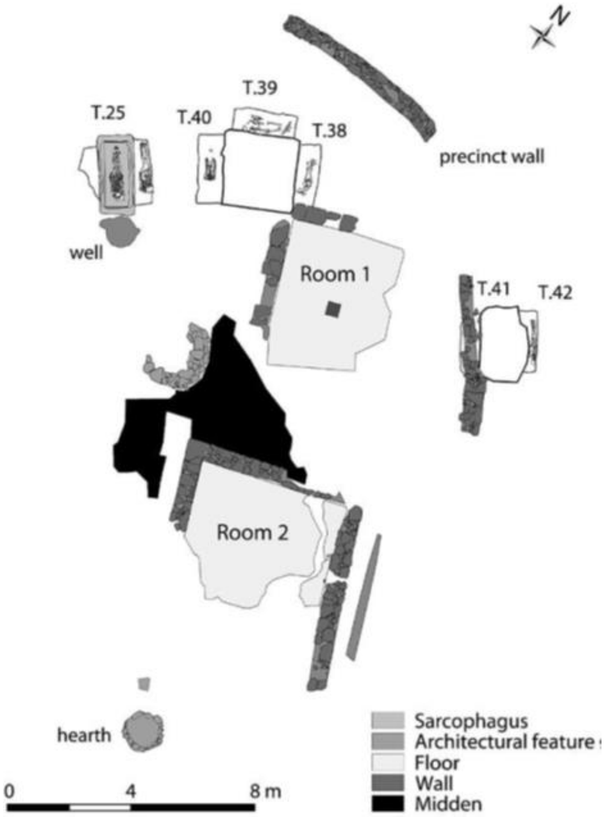


Figure 5: Occupation phases of Area D compound from 2019 GPR field report. a. the multi-hut compound, b. the single-hut compound, c. the stone complex (phase 1), d. the stone complex (phase 2), e. the late and post-archaic burial ground (Evans et al, 2019)

The final stage of the stone complex (Phase D in Figure 5, see also Figure 6) is a renovation following the burning of the first phase and should be given particular attention as the samples investigated in this thesis stem from this stage of occupation.



It is believed that the complex of Area D was occupied by the same family over several generations. The large area, walls, and repeated renovation as well as the richness in remains of the infant burials is testament to the status of the household. Evidence has also been collected from within the structure which shows a wide range of domestic activity from textile production to crop processing and animal husbandry. (Evans et al, 2019).

Figure 6: Area D plan of phase 2 of the stone complex and post-abandonment burial grounds (drawing by R. Opitz). (Mogetta, 2014)

2.3 ARCHAEOBOTANY AT GABII

The GPR has always assumed a multi-disciplinary approach to artefact recovery. Plant and animal remains have been collected since the beginning with the specific focus of investigating questions of subsistence and economy in an urban setting. Research has focused on the development of food supply and production, the city's population and the consequent interaction between the city and its rural surroundings (Motta, 2016).

It is these questions that will also be addressed in this thesis. Through the study of formation processes and plant assemblages, the goal is to understand the characteristics of crop processing in this phase of Iron Age Area D and their possible implications on the labour organisation and agricultural choices of the complex.

Due to the nuanced nature of urban deposits, a critical approach has been taken in the sampling of archaeobotanical remains. In Motta's article *'Archaeobiology at Gabii: sampling and recovery strategies in an urban context'*, contexts are evaluated for potential yield based on a precedent set during the excavation of Area A. Here, the effects of blanket and judgemental sampling were compared in terms of yield and time/cost-effectiveness. Dry sieving, manual collection and flotation techniques were applied, and the overall sample density and identifiability were assessed. Certain preservation patterns were found, for example, high levels of construction debris significantly harmed plant and bone survival. These methods were applied and once again evaluated in Area B. As a result, a judgemental sampling technique was chosen for the recovery of ecofacts across the entire excavation. Blanket sampling is applied to all Iron Age occupation levels, however all other layers were to be assessed before collection (Motta, 2016).

A total sampling strategy was applied in Area D because of the tight chronological span of the structures in an attempt to maximise recovery rates (Evans et al, 2019). Thus far, investigations have revealed a limited range of plant remains which will be discussed in conjecture with the results of this thesis in chapter six.

Chapter III: Materials and Methods

3.1 SAMPLE LIST

Twenty Area D flotation samples in total were selected for analysis in this thesis as seen in Table 1 below. Nineteen were recovered during the 2011 excavation of the stone complex, with one additional sample from 2012 at the point when the GPR turned their focus to the underlying, earlier layers of the complex. Of the twenty samples analysed fourteen are from Room 2; three are from Room 1; and three are from the open areas of the complex.

Flotation of these samples was conducted on-site during the GPR 2011 and 2012 excavation seasons using a SMAP style machine with a barrel capacity of 110-150 litres and a minimum mesh interval of 0.25 mm.

Three samples had been previously divided: 3060 and 3074 were split into two bags which were counted together but kept separate. 3028 was a very small sample contained in two vials which were also counted as a unit but stored apart. Furthermore, there were previously identified millet grains, which were checked and held separately but contributed to the final count.

Table 1. Sample list of stratigraphic units (1st column), soil sample volume (2nd column) and light fraction (i.e. FLOT) dry volume in millilitres (3rd column) and grams (4th column)

GPR11 AREA D	SOIL SAMPLE (L)	FLOT VOLUME MILILITRES (ml)	FLOT WEIGHT GRAMS (g)
SU 3012	4	24.0	5.1
SU 3025	24	32.5	12.4
SU 3027	18	30.0	5.5
SU 3028	13	3.5	1.1
SU 3044	16	12.0	6.0
SU 3045	16	7.0	1.9
SU 3046	16	12.5	9.7
SU 3048	14	7.5	2.8
SU 3052	18	6.0	3.3
SU 3055	14	17.5	7.1
SU 3056	16	15.2	6.7
SU 3060	14	60.0	24.5
SU 3061	16	46.0	14.3
SU 3065	14	10.0	4.9
SU 3071	17	15.0	8.2
SU 3072	21	27.5	9.8
SU 3073	16	40.0	7.9
SU 3074	18	37.5	27.0
SU 3075	16	5.0	1.6
GPR12 AREA D	-	-	-
SU 3183	19	55	21.1

3.2 SEPARATION METHODS

Table 2: A complete list of equipment used in the sorting and identification process.

Function	**Equipment**
Weighing	Micro scale; ML measuring vial
Separation	4-tier nesting sieves (2.0; 1.0; 0.5; 0.2 mm intervals); 1x large plastic tray; aluminium foil
Sortation	Zeiss Stemi SR stereo microscope; glass petri dishes; fine paintbrush; tweezers; fine grain sand
Identification	Online and offline reference handbooks, manuals, articles; modern reference materials; expert consultation.
Documentation	Leica M205C stereo microscope; Leica IC80 HD photo camera; editing software: Helicon Focus and Adobe Lightroom; notebook and pen; Microsoft Excel
Storage	Plastic cap glass vials; cut paper labels; plastic bags; permanent marker

The first step before separation was to weigh the samples. The volume of the floated sediment had been recorded at the time of excavation and was ascertained from the GPR database[13]. Following this, each light fraction was measured in a vial for volume in millilitres and weighed using a microscale for weight in grams. The weight was recorded to the second decimal before being passed through four nesting sieves with mesh intervals of 2.0, 1.0, 0.5, and 0.2 mm respectively. A plastic tray lined with aluminium foil was placed underneath to collect any residual sediment. Once sieved, each size interval was poured into a different plastic bag ready to be investigated under the microscope.

Microscopic analysis was conducted using a Zeiss Stemi SR stereo microscope with magnification options of 0.8; 1.2; 2; 3.2; 5. The sediment was sorted according to size bracket from largest to smallest.

The priority in sorting each sample was to find and identify macro-plant remains. Carbon was set aside from the 2.0 mm bracket as it could be useful in future studies or potential isotopic analysis. Seeds and chaff were separated from the sediment in each size bracket and sorted according to taxa. Wherever possible identification was attempted to a species level, however due to poor preservation and/or the close similarity of some seeds to others, which would have required a herbarium-sized plant specimen to accurately differentiate the species, this could not always be done. In such cases, efforts were made to determine either genus or family. Bigger caryopses of domesticated grasses which were determined by their size but identification was not possible were

[13]GPR database https://gabii.cast.uark.edu/data/

labelled "*cereals*" or "*cereal fragments*". These classifications were mostly reserved for remains in the 2.0 mm mesh interval, however cereal fragments were also taken from the 1.0 mm bracket.

Remains that were identified to a genus level were labelled "sp". When this was not possible, partial remains were labelled as "*fragments*" and whole remains as *"NID" i.e.* non-identifiable. In cases where diagnostic features were present but no identification was made, seeds were labelled "*unknown*". Tentative classifications were labelled as "cf".

Separated taxa were stored in individual glass vials each with a cut paper label stating their stratigraphic unit and classification.

Once all remains had been sorted and classified, they were counted. For all taxa, each whole seed was considered a single unit, as were large fragments with diagnostic features (*e.g.* seed halves with embryos). Unidentifiable fragments were counted and collected from the 2.0- and 1.0-mm intervals. 0.5 mm fragments were collected, however they were not included in the count as they could not definitively be identified as cereals.

During documentation, a note was also made of the rate of modern contamination as this is often a factor in ecofact degradation (Fritz and Nesbitt, 2015). This contamination took into consideration modern plant tissues such as roots or seeds, insect carcasses, modern and carbonised insect droppings and mushroom spores. The presence of these modern contaminants was rated by eye on a scale of one to four as shown in Table 3.[14]

Table 3: Score and criteria for modern contaminants in samples from least to most severe.

Score	**Definition**	**Description**
1	Minor contamination	Approx. 0-25% modern plant tissue or insects found in the sediment. High presence of whole carbonised material. Minimal fragmentation.
2	Medium contamination	Approx. 25-50% modern plant tissue or insects found in the sediment. High presence of whole carbonised material. Some seed fragmentation.
3	Significant contamination	Approx. 50-75% modern plant tissue or insects found in the sediment. Fragmented seeds significantly outnumber whole carbonised material.
4	Major contamination	Approx. 75-100% modern plant tissue or insects found in sediment. Little to no whole seeds preserved. Carbonised fragments are little to none.

The final step before storage was documentation. This process was ongoing throughout as weight, classification, and all other parameters were recorded instantly. However, it is best when recording archaeobotanical remains to also feature visual references. Images of specifically selected seeds

[14] For ratings see Table 5 in chapter five.

were taken using the Leica M205C stereo microscope with the Leica IC80 HD camera. These images were then edited to maximise visibility using editing software Helicon Focus and Adobe Lightroom to remove shadows.

3.3 IDENTIFICATION TECHNIQUES

Carpological remains are identified based on key characteristics unique to certain taxa. In traditional archaeobotany, this identification is carried out by use of microscopy. Diagnostic features vary between seeds, however, there are a multitude of characteristics to consider including shape, size, proportions, and surface ornamentation. For this it is important to view the seed from multiple angles as depicted in Figure 2.

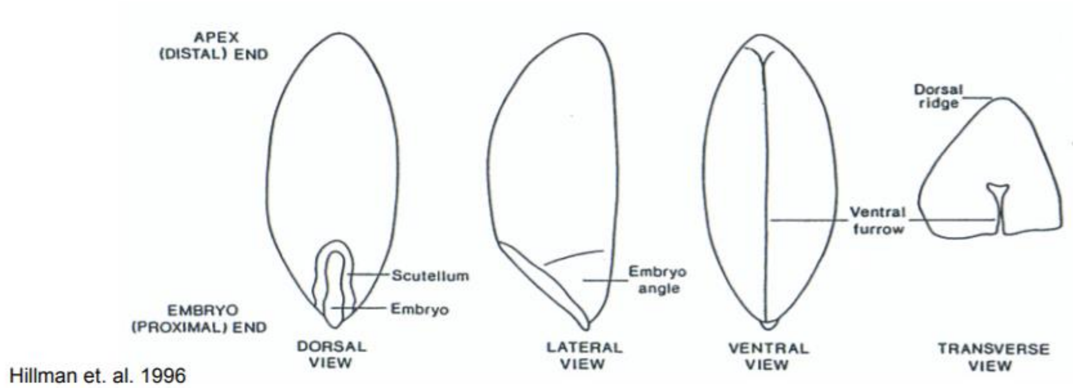


Figure 7: Wheat grain kernel depicted in dorsal, lateral, ventral, and transverse (also known as apical) view (Jacomet, 2006).

It is also possible to examine variations in features present in seeds from several families. The hilum, found on the ventral view, is the scar from where the seed was attached to the ovule stalk. It exists in various depths and formations. In cases such as Figure 7 where the hilum is linear and deep, a ventral furrow is formed. Unfortunately, little literature on hilum morphology exists in archaeobotany as it is not considered to have much diagnostic value (Nesbitt, 2006). However, it often survives carbonisation. Pursuant to further research or application of modern botanical research, it has the potential to inform on taxa and crop processing techniques (Cappers, 2018). The embryo, found on the dorsal view, may also provide further insight in species identification in terms of size, angle and position (Jacomet, 2006).

As mentioned in chapter one, carbonisation causes significant distortion to the morphology of seed remains. It is for this reason, that modern botanical techniques and reference materials cannot easily be applied to archaeobotanical assemblages. Instead, specialised references have been created and thorough experimental studies have been conducted in order to discover whether charring patterns can be predicted (Boardman and Jones, 1990) and what taxa are most likely to enter the archaeobotanical record (van der Veen, 2007).

The remains analysed in the studied assemblage were affected by charring in various ways, many beyond recognition. Common obstacles included bubbling in which air pockets appeared in the remains and swelling occurred (see Figure 8); corrosion where the surface layer of the seed was worn away by the sediment (see Figure 9) and overall dirtiness which would limit the view of the seed and could not be removed due to their fragile nature.

Figure 8: Triticum sp. *grain damaged by bubbling during charring.*

Figure 9: Triticum sp. *grain damaged by corrosion*

In the identification process of this thesis, seed and chaff classification required a wide range of material and consultation with experienced archaeobotanists. Reference atlases were used for the identification of the seeds, both printed and online ones. Particular use was made of '*A Manual for the Identification of Plant Seeds and Fruits*' by R.T. J Cappers and R.M. Bekker (2013), and the '*Digital Atlas of Economic Plants in Archaeology*' by R. Neef et al (2012). In addition, '*Identification of cereal remains from archaeological sites*' by S. Jacomet (2006) was consulted when differentiating between cereal remains.

Further use was made of online databases such as '*Digital Seed Atlas of the Netherlands' (2006-)* and '*The Euro+Med Plant Base'(2006-)* in order to determine seed dimensions and provenance. Due to the focus on Dutch plant taxa in most of these atlases, identifications were also supplemented by taxa specific articles from archaeological sites in the Mediterranean (eg. Miller and Enneking, 2014; Riel 2019).

Throughout the sorting process, certain taxa were found to be much easier to recognise than others due to their distinct shape or morphology. Barley grains, for example, have a symmetric, boat-like shape which makes them easy to distinguish even when fragmented or poorly preserved. In contrast, wheat grains exist as a variety of species each of which differs subtly in shape, thus a more complete view of the grain's profile was required for definitive identification. It is, therefore, likely that due to the preservation state and overall better ease of recognition that a disproportionate number of barley grains and fragments were identified.

A similar issue occured in the differentiation of millet taxa. Though millet grains have a distinct form, these differ only slightly among species making it difficult to remove subjectivity from the identification process. The similarity between taxa was also an issue for many of the smaller seeds from the 0.5 mm mesh interval. Furthermore, while cereal taxa are generally consistent throughout archaeobotanical assemblages in Europe (van der Veen, 2007), wild seeds are much more location dependent, making it difficult to rely on pre-existing literature. Local assemblages were used to attain an idea of what may exist in the area, however, a large amount of consultation was required in this part of the process.

Another limitation to the samples' assessment occurred in the sorting order. For training purposes, the samples were sorted by size interval rather than by SU. The fact that SUs were not processed individually may have hindered the overall impression they gave as it stopped them from being seen as an unit until counting. This has the potential to affect the overall contamination assessment referenced in Table 3, as will be seen in chapter five.

Chapter IV: Results

A total of 2,129 seeds and fragments, and 8,982 cereal fragments were counted in the samples. The identifiable taxa were classified into 16 families, 37 genera, and 43 recognisable species as seen in Figure 10. Most prevalent by far was the Poaceae family, also known as the grass family where 13 genera and 15 species were found. The second most featured group was the Fabaceae family with 6 pulse genera and 8 species.

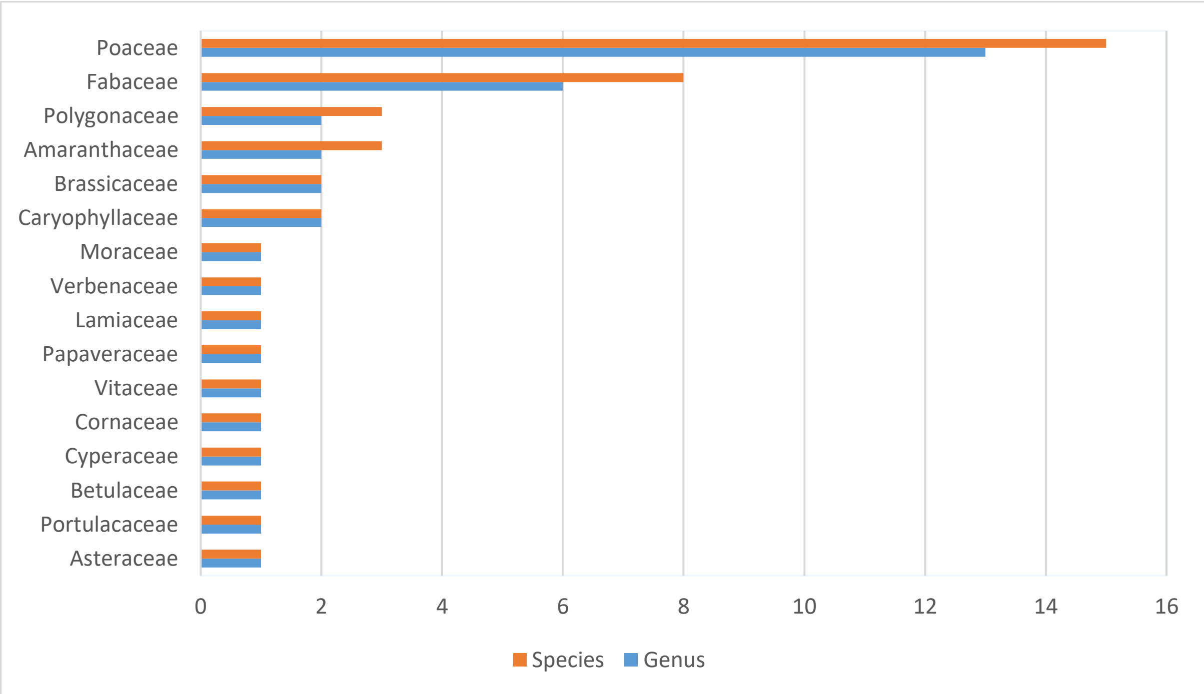


Figure 10: Absolute count of genera (blue) and species (orange) detected in samples. X-axis: numbers present. Y-axis: Plant families.

After these two main groups, there was a decrease in taxa present from each family. 3 species and 2 genera were detected from the Polygonaceae, knotweed, family and the amaranth family, Amaranthaceae. 2 genera and 2 species were found from the Brassicaceae, cabbage, family and Caryophyllaceae, pink, family. Only 1 genus and species were found in each of the remaining groups: the mulberry, Moraceae family; the vervain or verbena family, Verbenaceae; the deadnettle family, Lamiaceae; the poppy family, Papaveraceae; the Cornaceae family; the grape family, Vitaceae; the sedge family, Cyperaceae; the birch family, Betulaceae; the purslane family, Portulacaceae; and finally the daisy family, Asteraceae.

To understand the agricultural practices, the taxa have been divided into three distinct groups; staple crops; arboreal fruits and nuts; and arable weeds. In order to understand the relevance of each taxa discovered, a brief summary of their characteristics and environment is found below.

Identified taxa	Type of remains	Total number
Hordeum vulgare	Grains	450
Triticum dicoccon	Grains	302
Triticum cf. *dicoccon*	Grains	17
Triticum dicoccon	Chaff	61
Triticum monococcum	Grains	26
Triticum cf. *monococcum*	Grains	9
Triticum monococcum	Chaff	8
Triticum sp.	Grains	131
Triticum sp.	Spikelet forks	32
Triticum sp.	Glume bases	112
Triticum cf. *aestivum/durum*	Grains	1
Panicum miliaceum		70
Setaria italica		27
Millet		27
Cereals		226
Cereal fragments		8975
Lens culinaris		1
Vicia ervilia		15
Vicia faba		8
Pisum sativum		5
Fabaceae		61
Amaranthaceae		1
Chenopodium cf. *album*		1
Chenopodium sp.		1
Asteraceae		1
Corylus avellana		1
Brassicaceae		2
Raphanus raphanistrum		3
Arenaria		2
Silene spp.		10
Cyperaceae		1
Cornus mas		13
Medicago sp		1
Trifolium cf		1
Trifolium pratense		4
Trifolium scabrum		2
Mentha sp.		2
Ficus carica		9
Papaver sp.		3
Alopecurus sp.		9
Briza sp.		2
Bromus sp.		1
Cynodon sp.		5
Echinochloa sp.		7
Hordeum spontaneum		3
Lolium temulentum		213
Lolium multiflorum		4
Lolium sp.		12
Lolium cf.		7
Phalaris		2
Poa sp.		8
Poaceae (Bromus like)		8
Poaceae		79
Polygonaceae		5
Rumex cf *crispus*		1
Rumex sp.		3
Portulaca oleracea		16
Verbena officinalis		4
Vitis vinifera		15
Unknown		55
NID		30

Table 4: Species list and total number of remains (seeds and fragments) identified in samples.

Staple crops first ordered by family: Poaceae and Fabaceae followed by wild plants and weeds in alphabetical order of family.

Chaff counted as individual glume bases.

T.dicoccon:

1 grain = 0.5 spikelet forks = 1 glume base

T.monococcum:

1 grain = 1 spikelet fork = 2 glume bases

For Triticum sp. *counted separately.*

4.1 STAPLE CROPS

CEREALS

Of the 15 species identified from the Poaceae family, 4 genera are known domesticated cereal crops: *Hordeum, Triticum, Panicum* and *Setaria.*

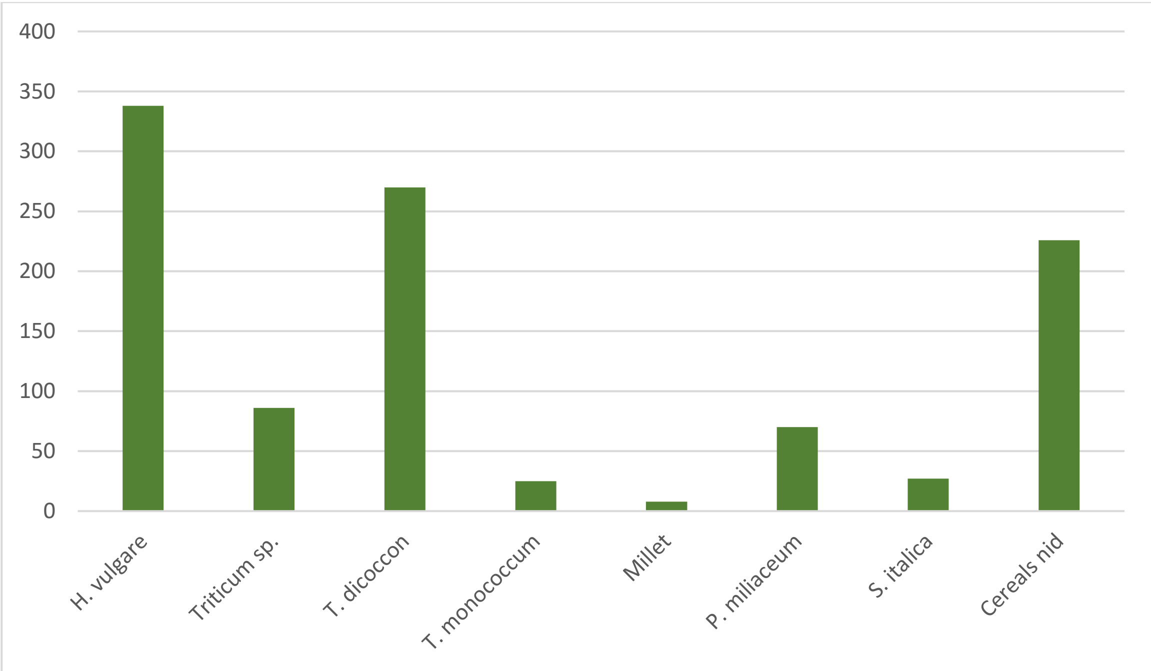


Figure 11: Absolute count of whole cereal grains by taxa found in the samples.

Hordeum vulgare L. or barley was by far the most commonly found taxa. Barley has a long-standing history of cultivation for food and fodder with archaeobotanical evidence going as far back as the mid-late Neolithic period in Mesopotamia (Riehl, 2019). This is likely due to its incredible adaptability and stress tolerance. Domesticated barley can thrive in remarkably high or low temperatures and varying levels of moisture. The plant is high yield with a short production cycle, producing grains with high nutritional value and long-term storage capabilities. Barley exists in hundreds of different species and subspecies variations, three of which were recognised in this assemblage: *Hordeum vulgare* subsp. *distichon; H. vulgare* subsp. *exastichon;* and *H. vulgare* subsp. *spontaneum*.

H. vulgare distichon, 2-row barley, and *H. vulgare exastichon*, 6-row barley, are the two domesticated variations present in this sample. The difference in these species is determined by infructescence and the number of spikelets capable of producing fruit. 2-row barley was the first to be domesticated (Cappers, 2018) and is still similar in morphology to its wild relative subsp. *spontaneum* thus capable of producing one fertile spikelet. In contrast, 6-row barley will produce three fertile spikelets, two of which will yield twisted grains (see Figure 12). The presence of 6-row barley can be confirmed by finding these twisted grains, however, an exact count cannot be made as the straight grains cannot be differentiated to a subspecies level without the entire spikelet[15].

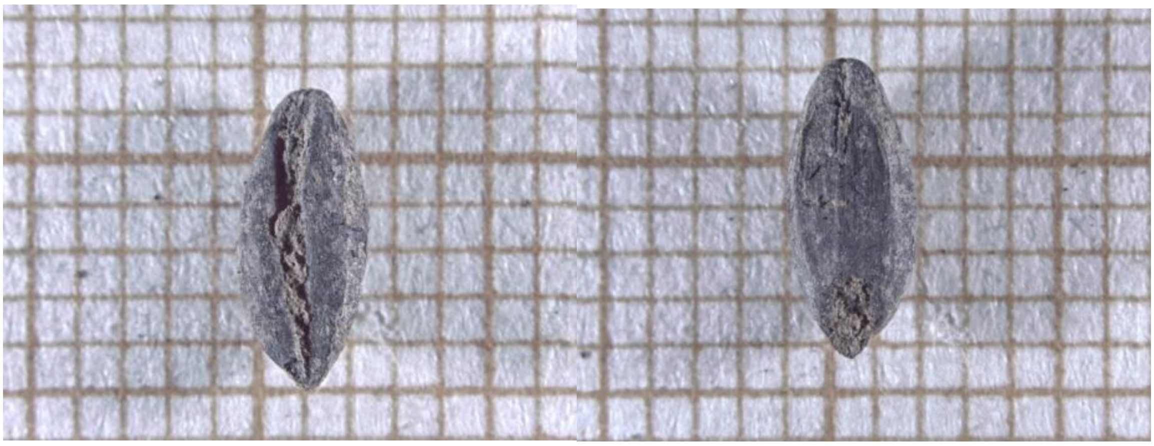


Figure 12: Ventral (left) and dorsal (right) view of a twisted 6-row hulled barley ie. H.vulgare subsp. *exastichon (SU3025)*

Overall, 329 seeds and 112 fragments of *H. vulgare* were definitively identified. Of the whole seeds found, 8 were classified as twisted *H. vulgare exastichon* seeds. In addition, 9 seeds were found and classified as *H.* cf. *vulgare*, amounting to a total of 450 domesticated barley remains. All the seeds were hulled.

The second most abundant genus present was *Triticum*, the wheat genus. In this case, both grains and chaff were discovered as is often the case with carbonised material (van der Veen, 2007). In comparison to barley, domesticated *Triticum* fares poorly in extreme conditions, having been found to be easily affected by seeding rate and water availability (Troccoli and Codianni, 2005). However, certain species such as emmer and einkorn have been found to be dominant in many archaeobotanical assemblages from sites contemporary to Gabii in the area (Izzet, 2000; Motta, 2002). Domesticated wheat occurs in 6 species and various subspecies determined by chromosomal pair number per nucleus, from diploid (one pair) to tetraploid (two pairs). Physically they are also divided into hulled and naked wheats according to rachis brittleness and hull tightness. In the samples, 3 taxa were found: *T. dicoccon* Schrank.; *T. monococcum* L.; and *T. aestivum/durum* L..

[15] According to Jacomet, (2006) 2-row barley can also be diagnosed if the maximum width of the seed is just below the middle of the grain, however, this process was not considered due to seed distortion caused by carbonisation and the subjectivity of the feature.

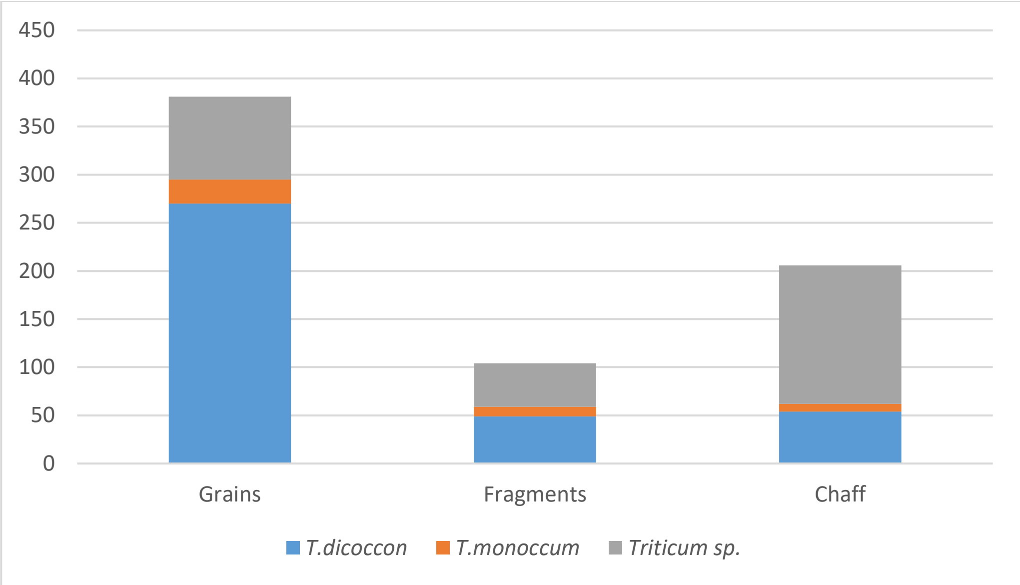


Figure 13: Proportional frequency of Triticum spp. *whole grains, fragments and chaff (glume bases and spikelet forks each counted as individual units) by species, T.dicoccon (blue), T.monococcum (orange) and Triticum* sp. *(grey)*

T.dicoccon Schrank, also referred to as *T.dicoccum* Schübler or colloquially as emmer wheat, is a hulled tetraploid wheat. Of the 3 species discovered, emmer was by far the most common. Present in significantly lower numbers was the hulled diploid *T. monococcum i.e.* einkorn. Only one grain of *T.aestivum/durum*, or naked wheat, was discovered, it has therefore been omitted from Figure 11 and 13 above. The remaining grains were classified as *Triticum* sp. due to the degree of degradation.

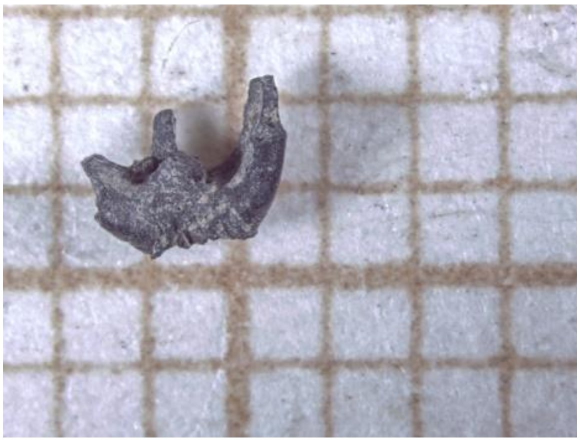


Figure 14: T. dicoccon spikelet fork (SU3012) diagnosed by fragmented primary keel orientation

In general, most grains could be recognised to a species level. As seen in Figure 13, the difficulty came in discerning chaff and fragments; only approximately half of the fragments carried diagnostic characteristics and these were even fewer in chaff. To identify the species of wheat chaff, the disarticulation scar of the spikelet fork and the primary keel of the glume base need to be intact, however due to their delicate nature, these were rarely present.

A particular note should be made of one *Triticum* sp. grain found in SU3025. This grain as seen in Figure 15 had a wrinkled exterior indicative of an unripe seed.

The least abundant staple crop was millet. This is a broad term used to refer to a variety of small grain cereals. In this case, the millet grains found were identified as *Panicum miliaceum* L. and *Setaria italica* L., colloquially known as broomcorn and foxtail millet respectively.

Figure 15: Unripe Triticum sp. *grain with wrinkled surface ornamentation (SU3025)*

Unlike many cultivated cereals which made their way into Europe via the Near East in the 7th millennium BCE, broomcorn and foxtail millet arrived to the Mediterranean much later with widespread cultivation not occurring until the 1st millennium BCE (Buxó and Piqué, 2008 cited in Moreno-Larrazabal et al., 2015[16]).

P. miliaceum and *S. italica* are hardy, drought tolerant plants whose seeds are similar in appearance, which can often lead to the misdiagnosis of species. As a result of concern expressed regarding this, studies have been conducted to clarify charring patterns in broomcorn and foxtail millet, (Motuzaite et al, 2011; Walsh, 2016) however, of the 124 seeds analysed, 27 could not be narrowed down to a species level. Ultimately, *P. miliaceum* significantly dominated the sample with more than the *S.italica* and non-specific millet combined.

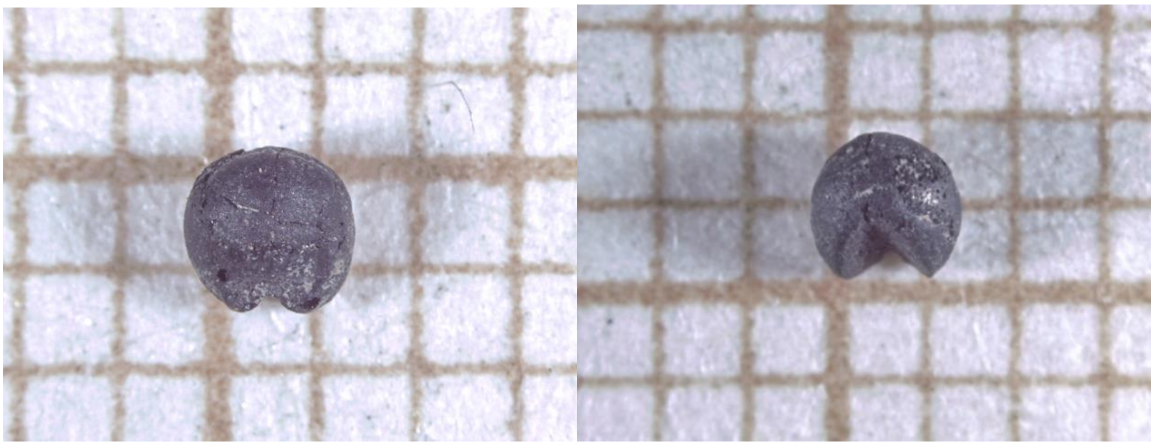


Figure 16: Frontal (left) and dorsal (right) view of Panicum miliaceum L. *(SU3074)*

[16] Secondary citation used when translated copy of the original article could not be found.

LEGUMES

Along with cereals, legumes constitute some of the first plants to be cultivated by humankind. Domestication is believed to have occurred for various taxa in the Near East around the 8th or early 7th millennium BC with legumes becoming a well-established crop for the majority of communities in the Mediterranean by the Bronze Age (Zohary and Hopf, 1973). Agricultural preference for legumes is likely due to their stress tolerance and broad environmental distribution. Legumes have a high nutritional value with similar carbohydrate levels to cereals but significantly higher protein content. In contrast to cereals which occupy large stretches of land, these plants tend to be more concentrated. Legume plants have shorter growth cycles which allow for harvest approximately a month earlier than cereals, and do not require a similar level of post-harvest processing. Consequently, legumes are consistently found in archaeobotanical studies with typical taxa including broad beans, lentils, peas, bitter vetch and chickpeas (Valamoti et al, 2011; Zohary and Hopf, 1973).

Domesticated legumes belong to the Fabaceae family which is one of the largest plant families with a diverse range of morphological features. Inflorescence and infructescence occur in multiple ways however the most common Fabaceae fruit, the legume, will generally grow as fused carpel, or pod, with the coated seeds growing in a row inside. Upon detachment, the fusion with the pod will leave a hilum scar which is clearly visible. Fabaceae seed shapes are incredibly diverse, as a result, in the samples studied, legumes were largely distinguished by seed morphology. Four domesticated species were found.

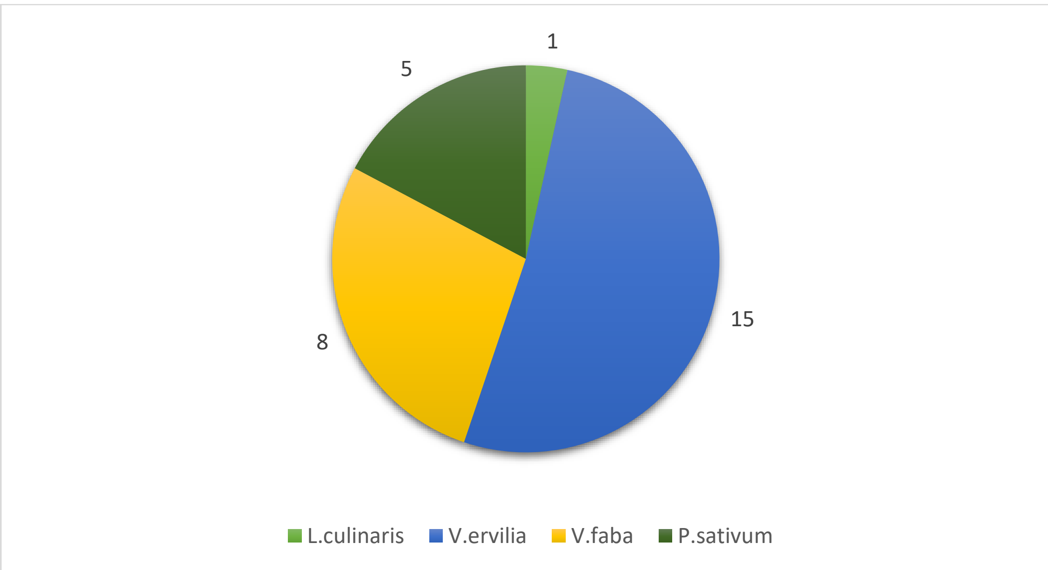


Figure 17: Number of domesticated Fabaceae pulses and fragments by species found in the samples.

Vicia ervilia L., colloquially referred to as bitter vetch, was the most featured legume in the assemblage. Like barley and hulled wheat, bitter vetch is a founder crop and is native to the Mediterranean. The common consensus is that bitter vetch originated as a food crop, however, due to its taste and toxic nature when consumed in large quantities, was relegated to fodder as other legumes took its place (Miller, 2014). Despite its unpalatable nature, bitter vetch has a high nutritional value from protein and is often found at archaeological sites even when no signs of pastoralism are present bringing this belief into question (van Zeist and de Roller, 2003).

V.ervilia pulses are found at the 2.0 mm scale and are easily distinguishable by their triangular morphology. 15 pulses were found in total, amounting to more than twice as many as the second most frequent legume, *Vicia faba* L..

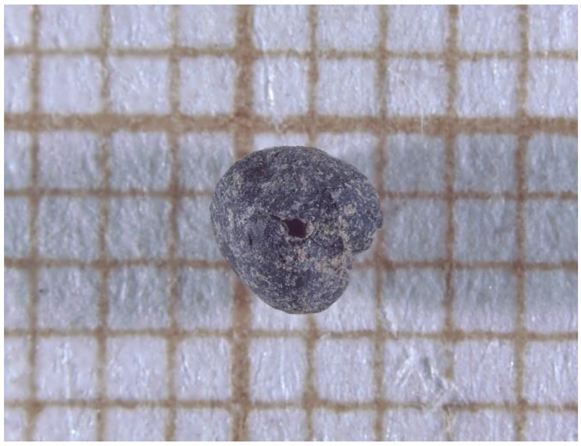


Figure 18: Vicia ervilia, top/apica view

Vicia faba L. or fava/broad beans, were one of the physically largest species in the assemblage and thus easy to distinguish. Broad beans share many traits with bitter vetch, including a slight toxicity when consumed raw. However, unlike bitter vetch which declined in popularity as Rome expanded (Zohary and Hopf, 1973), broad beans have had continuous economic value through to present day as both food and fodder.

V.faba beans today occur as three subspecies determined by their size; *V.faba* subsp. *minuta* L. *(=* subsp. *minor); V.faba* subsp. *equina* L.; and *V. faba* subsp. *faba* L. (= subsp. *major).* 8 broad beans were found in the samples analysed. Due to the sizes of the whole pulses and the fragments, they have been classified as *Vicia faba* subsp. *minuta*.

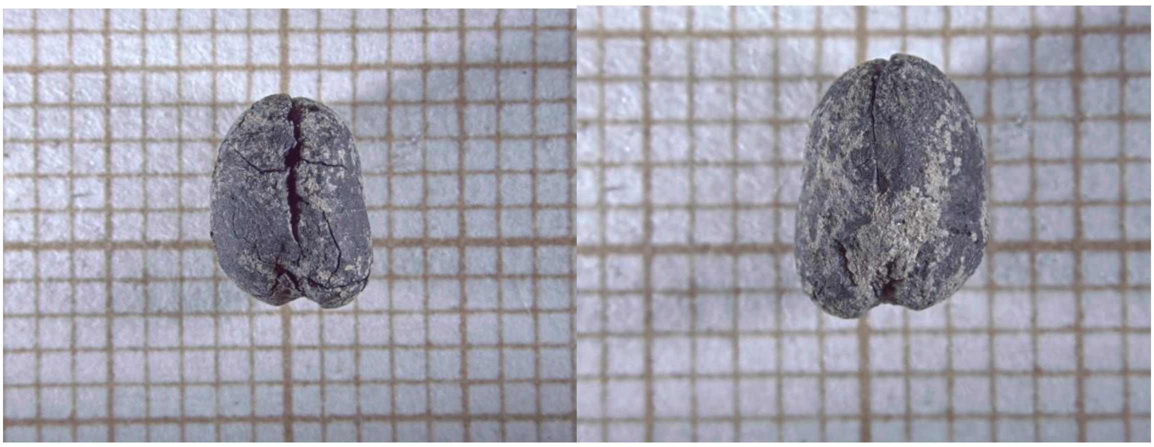


Figure 19: Frontal (left) and dorsal (right) view of Vicia faba subsp. *minuta (SU3071)*

Figure 20: Lathyrus oleraceus Lam. *or P. sativum (SU3061)*

Lathyrus oleraceus Lam. *(previously P. sativum)*, the garden pea, is easily recognisable from its rotund nature and deep scutellum (see Figure 20). Pea plants have a short growth period and a pleasant taste, making them common place in human diet. A total of five peas were found in the samples.

Lens culinaris L. is the final domesticated legume found in the assemblage. It has a similar form to the garden pea, however, it is much flatter and ellipsoid in comparison, with the hilum located flush on a thin straight edge along the seam. One lentil was found in the assemblage.

4.2 ARBOREAL FRUITS AND NUTS

The plant remains covered in this section are wild taxa derived from trees or vines. The families included in the samples are Moraceae, Betulaceae, and Cornaceae. Since domesticated crops and arable weeds are both located in wide open fields, the arboreal fruits and nuts have been set apart for their potential to reveal more about the nature of woodlands in the area.

Only one sample was found from the Betulaceae family, this was a *Corylus avellana* L., hazelnut fragment. These shrubs or trees can grow to between 4 and 8 metres in height and are found on woodland borders and in shrubberies. The fragment in these samples was found in SU3183 and identified using modern references and expert consultation[17]. While use has been made of hazel in wattle and daub constructions, hazelnuts primarily have a history of being exploited for culinary purposes (Enescu et al, 2016).

[17] Fragment diagnosed by Professor René Cappers during the University of Groningen Food From Field to Fork Summer School. July 22 -26, 2019.

Figure 21: Fragmented *Cornus mas* SU3060.

Cornus mas L., or cornelian cherry, was found in two stratigraphic units, SU3055 and SU3060. The seed fragments were easy to recognise and assemble due to their large size. Cornelian cherry plants present as either large shrubs or small trees between 2 – 6 metres (in extraordinary cases they may grow to be as tall as 8 metres). The fruit is edible and was found to be used in the brewing of alcoholic drinks in central Italy prior to the popularisation of the grapevine (Aranguren et al, 2007 cited in Marvelli et al 2013.). The wood has a long-standing history of being used for construction and weaponry in Antiquity (Da Ronch et al, 2016).

The remaining arboreal taxa discovered in the samples was from the Moraceae family. *Ficus carica* L., commonly known as fig, comes from a genus filled with a variety of species, including around 800 tree types. *F.carica,* in particular, are perennial large shrubs or small trees of up to 10 metres in height. The trees thrive in a multitude of environments, particularly on plantation borders and at cave openings. The fruit of the fig tree offers a sweet flavour high in fat and amino acids which historically has consistently served in culinary capacities and have been discovered as carbonised pips as early as the Bronze Age on sites across the Mediterranean and Near East (Zohary and Spiegel-Roy, 1975).

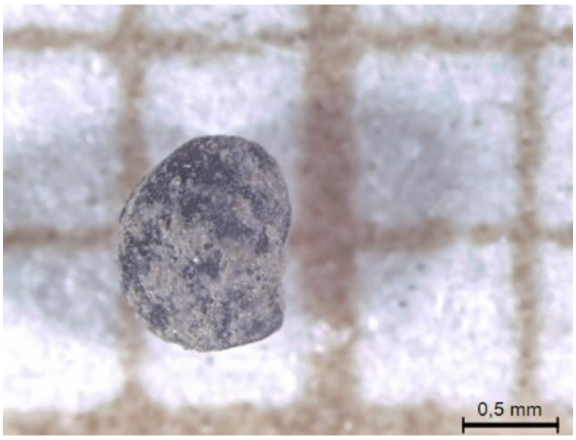


Figure 22: Ficus carica seed (SU3056)

The final variation of wild edible fruit does not stem from a tree but from a vine, *Vitis vinifera* L.. From the Vitaceae family, grape seeds exist as a multitude of species/subspecies with a long history of human exploitation. *Vitis* has been discovered in prehistoric archaeobotanical assemblages from Northern Greece to Switzerland (Zohary and Spiegel-Roy, 1975). The cultivation and domestication of grapes on the Italian peninsula is a matter still under debate, however evidence exists attesting to the fact that viticulture and grape exploitation have existed in Italy independent of domestication since the Neolithic age (Marvelli et al, 2013). Two subspecies in particular are worth mentioning in this context, *V.vinifera* subsp. *sylvestris* and *V.vinifera* subsp. *vinifera* which represent wild and domesticated varieties respectively.

In general, wild seeds are smaller and more rotund in form than their domesticated counterparts, however due to distortion during carbonisation and the cultural and economic implications that each species carries, importance has been given to standardising identification through formulas (Mangafa and Kotsakis, 1996) and more recently GMM analysis (Portillo, 2019).

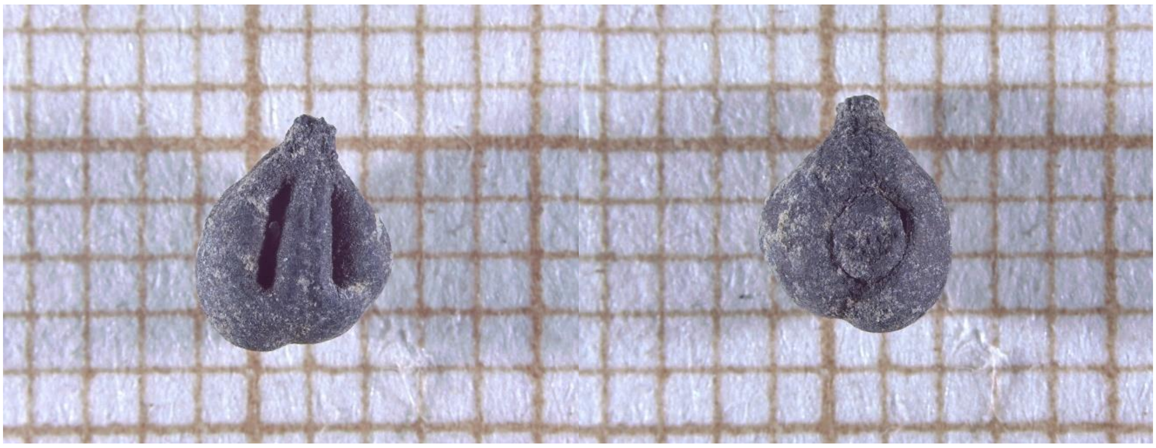


Figure 23: Frontal (left) and dorsal (right) view of a Vitis vinifera cf. *sylvestris* L., *grape pip (SU3046).*

15 *V. vinifera* seeds, 6 whole and 9 fragments, were found in various states of degradation. The pip found in SU3046 was by far the best preserved (see Figure 23). Although statistical analysis would be necessary for a definitive subspecies identification, it can be suggested that this pip is the wild variety *V.vinifera sylvestris* due to the rotund shape. These wild seeds are currently found in lowland forests.

4.3 ARABLE WEEDS

The remaining 22 taxa identified in the samples are made up of arable weeds, predominantly found in grasslands and/or fields. These seeds were found in the smaller, 1.0 mm or 0.5 mm, mesh intervals. Whereas domesticated crops usually have a uniform and predictable pattern, wild seeds represent a broad range of morphologies and are often difficult to narrow down to a species level.

In the Poaceae family the most common crop weed by far was *Lolium*. This seed made an appearance as two species: *Lolium multiflorum* L. *i.e* Italian ryegrass, and most commonly *Lolium temulentum* L i.e. poison darnel. With 236 seeds and fragments found in total, *Lolium* made up 48,7%

of the total arable weed population.[18] *Bromus* sp. seeds found were similar in size to *Lolium* seeds, whilst the other Poaceae taxa found were smaller meadow grasses, *Poa* sp. *Alopecurus* sp., *Cyodon* sp, *and Phalaris* sp. A note should also be made of the *Echinochloa* sp. seeds which are also sometimes considered a millet, however, the ones in this sample were a wild variety.

In addition to the domesticated barley, 3 grains of wild barley, *H. vulgare spontaneum*, were detected. Typically, a segetal or ruderal plant, wild barley is indicative of drier, open environments, and is often found near oak-dominated areas (Riehl, 2019). The grains can be recognised by their similar morphology to 2-row domesticated barley, however, wild barley is pinched at the scutellum, or the embryonic area on the dorsal side of the grain, leading to a spindle shape as seen in Figure 24 below.

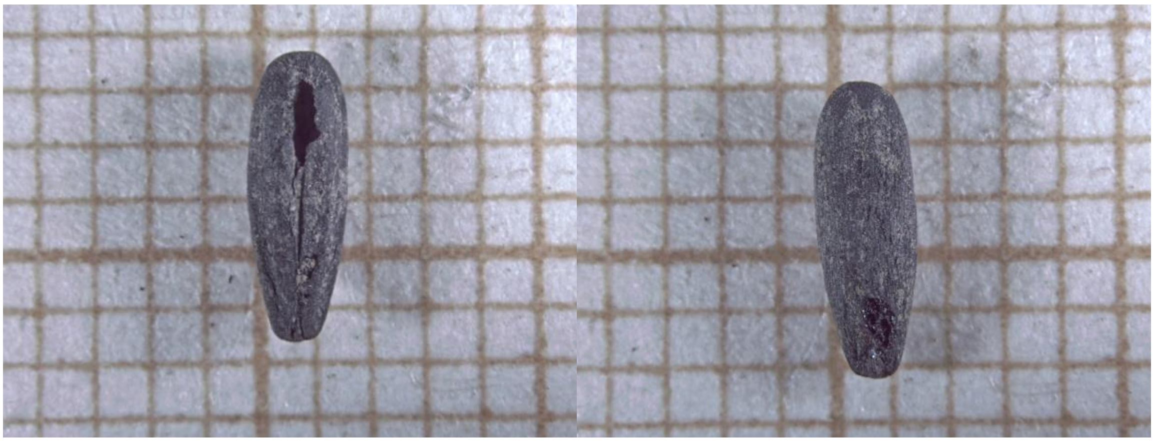


Figure 24: Hordeum vulgare subsp. *spontaneum ventral (left) and dorsal (right) view (SU3012).*

The Fabaceae weeds found were *Medicago* sp., *Trifolium scabrum* L. and *Trifolium pratense* L.. All three are varieties of clover used as fodder with a range of preferred habitats and are all found in meadows and fields.

3 seeds were found from the Amaranthaceae family: *Chenopodium album, Chenopodium* sp. and an unidentified Amaranthaceae. This is a crop weed, very common to nitrogen rich fields. The seeds are edible and a good source of lipids, however they are extremely small making them difficult to process, thus it has been suggested that they may have been consumed in times of food shortage (Moreno-Larrazabal et al, 2015).

Raphanus raphanistrum, or wild radish, was found from the Brassicaceae cabbage family. Three *Papaver* sp. seeds were found from the poppy family, Papaveraceae.

[18] Note that this number also takes into account non-cereal Poaceae seeds and fragments which could not be definitively identified. The number, in fact, may be much higher. Unknown and NID seeds excluded from the figure.

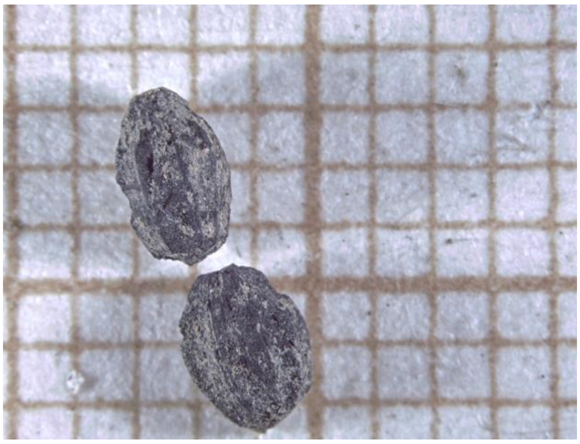


Figure 25: Raphanus raphanistrum (SU3048)

Of the Polygonaceae, 5 were unidentified and 4 were recognised as *Rumex* spp, one of which is possibly *Rumex* cf. *crispus* L. or curly dock, a perennial field weed.

The Caryophyllaceae are represented by *Silene* spp. and *Arenaria* sp. The *Silene* are theorised to be *Silene* cf. *gallica*, an annual to biennial flowering plant with several common names, however this is difficult to confirm due to close species similarity. *Arenaria* are perennial plants, colloquially called sandworts, with a preference for grassy fields and sandier terrains.

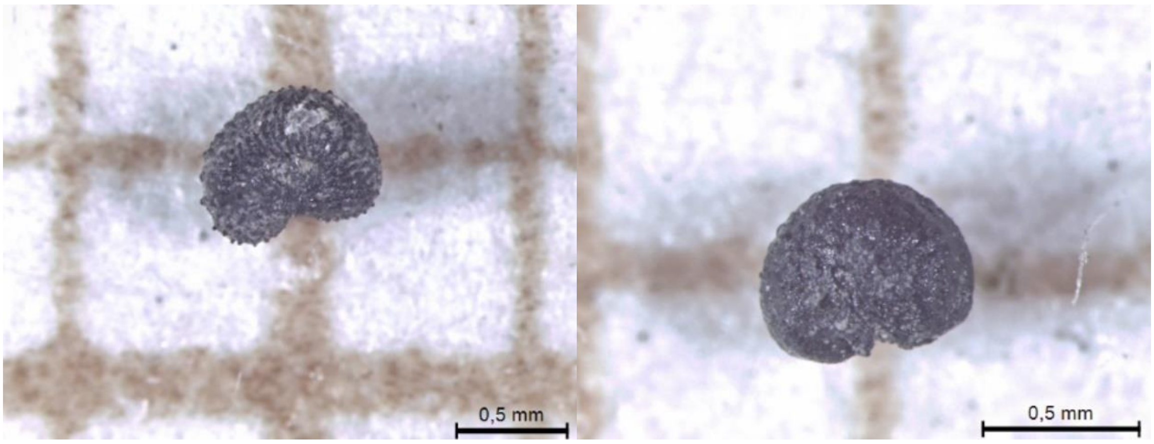


Figure 26: Silene cf. *gallica (left) and Arenaria* sp. *(right) (SU3061).*

A seemingly disproportionate number of *Portulaca oleracea* L., or purslane, seeds were found in the samples. With 11 of the 16 seeds being found in SU3065, it was considered whether this could be modern contamination from a nearby purslane plant, therefore, carbonisation of the seeds had to be confirmed. The seeds analysed were found to be ancient. Purslane is not out of place for this context, it is a succulent weed found in vegetable fields and vineyards. The seeds possess an easily distinguishable shape and ornamentation.

Verbena officinalis L. was found only in one stratigraphic unit, the unusually rich SU3061. This plant is a perennial herb, colloquially known as verbena or vervain, and is very much present even today.

There is documented use of *Verbena* as a medicinal herb (Tzedakis et al, 2008), however, it also occurs as a weed in soil rich in nitrogen which, due to the small number and other plants in the context, is much more likely to be the case here.

Figure 27: Verbena officinalis (SU3061)

Similarly, the Lamiaceae family also has species with a history of culinary and medicinal use such as peppermint. However, plants often grow as weeds in damper fields which is likely for the mint seeds in this sample.

A single seed was found from the Cyperaceae family which is suspected to be from the perennial grass-like genus, *Carex.* However, this has not been confirmed. An additional seed was classified by morphology as an Asteraceae seed although further identification was not made.

In addition to the samples covered, 55 seeds were classified as unknown and 30 as NID. Certain SUs contained an unidentified matter, suspected to be signs of food preparation but more information and consultation would be required.

Chapter V: Discussion

The study and identification of these twenty samples from Gabii's Area D provide an array of information. In the following chapter the items collected have been considered in two stages: first in terms of site formation processes by density, diversity, and preservation; second by archaeobotanical composition in terms of ubiquity and proportional analysis. These definitions are delineated so as to assess any possible taphonomic implications on the interpretation of the recorded data. It is essential that these effects are established in order to discuss the assemblage itself more efficiently.

The SUs of this thesis have furthermore been placed into one of three groups -Room 1, Room 2 or Open Areas- according to their location on the complex and will be acknowledged as such in the analysis below. This is done to view whether site location played any role in the criteria discussed.

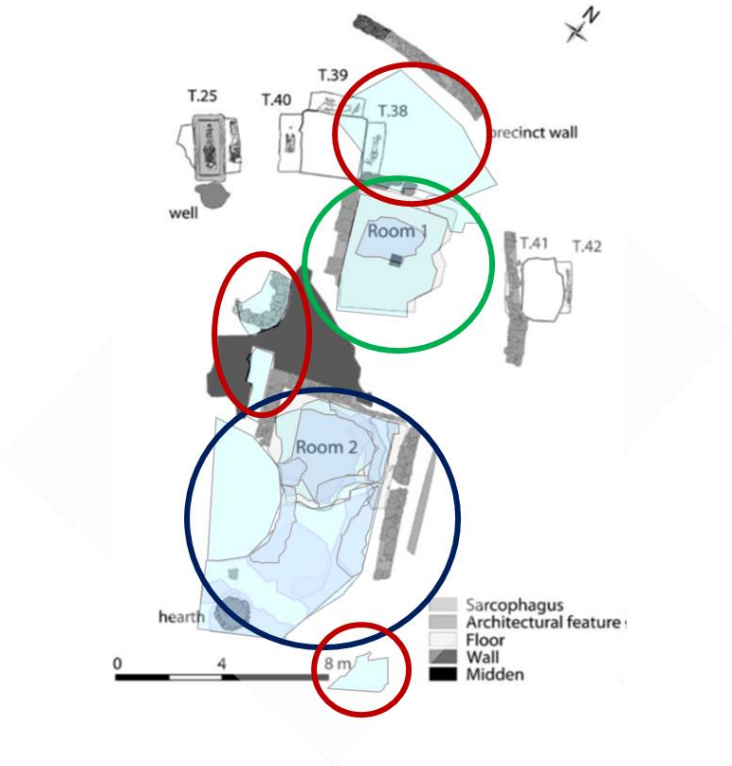


Figure 28: Map of Area D complex 6th century occupation phase (Mogetta and Becker, 2014). Shaded areas are SUs analysed. Encircled are the location groups: R1 (green), R2 (blue) and Open areas (red).

To begin with, the context of the layers must be established as it pertains to the information available in an assemblage. In their 1992 article, Hubbard and Clapham outline three classes of archaeobotanical deposit: primary, secondary and tertiary. They contend that in contrast to archaeology where artefacts may be the result of a limited number of events, the large majority of archaeobotanical assemblages are tertiary mixed deposits. To clarify, they are the result of several events over an extended period of time. Excluding exceptional circumstances such as the burning of a crop field or granary, carbonised plant remains are rarely found in situ. They are harvested and processed (first event), charred (second event), and disposed of (third event). However, this is only enough to define the assemblage as a secondary deposit. In order to become tertiary, these activities must be repeated and even repurposed (*e.g.* the use of refuse in the building of floor layers).

Thus far, the majority of archaeobotanical samples recovered from Gabii are tertiary mixed deposits (Motta, 2016). This is also the case for the contexts of this thesis which overwhelming stem from floors, fill layers and other surfaces within a tight chronology (see Appendix 1 for context information). Such deposits when chronologically contained inform on the location and distribution of routine processing activities, that is to say, the second and third depositional events. In contrast, the plant categories outlined in the previous chapter and which will further be discussed later in 'SU Composition', provide information on the first event, the harvesting and processing methods of the plants.

5.1 SU FORMATION

DENSITY

The concentration or richness of the SU's is determined here. Sample density was calculated as total number of remains per litre of sediment collected from each stratigraphic unit (see Figure 29). The samples with the highest ratio of material to sediment were found to be SU3012, SU3061, SU30183 and SU3056. These SU are notably all from open areas of the complex. In comparison, rooms 1 and 2 were low in density with none of them exceeding 43 items per litre. The lowest density was found in SU3027 where approximately 9 items per litre were counted.

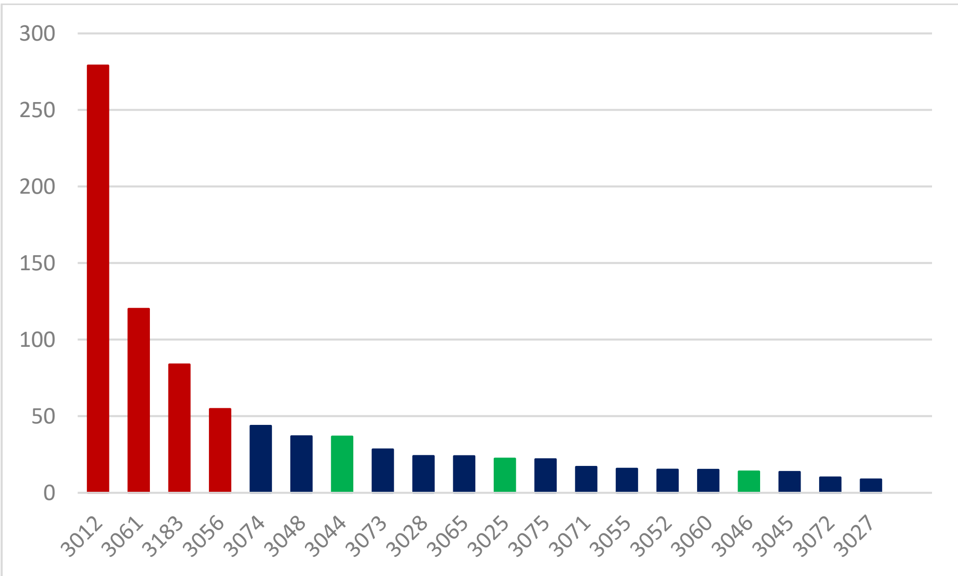


Figure 29: Sample density rate as total sample[19] count per litre of sediment ratio (y-axis). Categorised by SU (x-axis) and site location R1 (green), R2 (blue) and open areas (red).

[19] Total sample count: All identified species and all cereal fragments collected from 2.0- and 1.0- mm mesh intervals

DIVERSITY

The diversity of a sample is testament to the homogeneity of the assemblage. Here, each SU is considered by the number of species present. As could be expected, several of the denser units, notably SU3061, 3183 and 3056, also have a higher diversity, however there are some distinct changes. Although SU3027 has the lowest density of all samples analysed, it is tied for fourth place in diversity with 14 species found. This is mainly due to the array of small weeds discovered. A similar swap occurs with the densest sample SU3012 as this unit is cereal dominant. Certain units remain at the bottom of the scale as they are low in remains and in variety. This applies to SU3072 and SU3060.

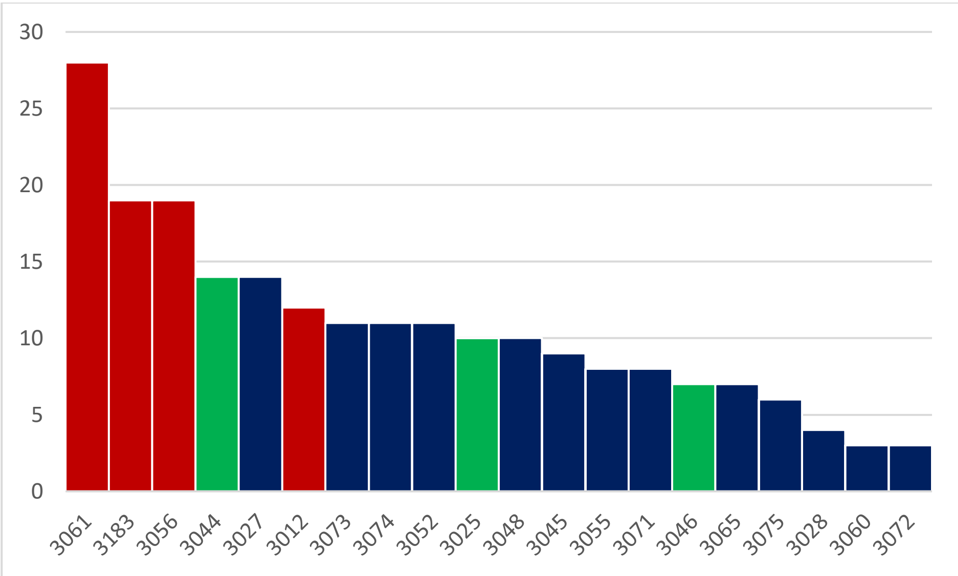


Figure 30: Diversity index based on number of species (y-axis) per SU (x-axis). Categorised by site location R1 (green), R2 (blue) and open areas (red).

As can be seen in Figure 30, here too, the open areas rate significantly higher than those indoors. The three samples from Room 1 are distributed in a similar pattern to what was seen in the density assessment. This also applies to the general distribution of the SUs from Room 2.

PRESERVATION

The final category to be considered in terms of formation processes is the preservation level. Preservation was calculated by the whole seed to fragment ratio and is a further attempt to assess the state of degradation mentioned in chapter three. The fragments considered include those gathered from the 2.0- and 1.0- mm mesh.

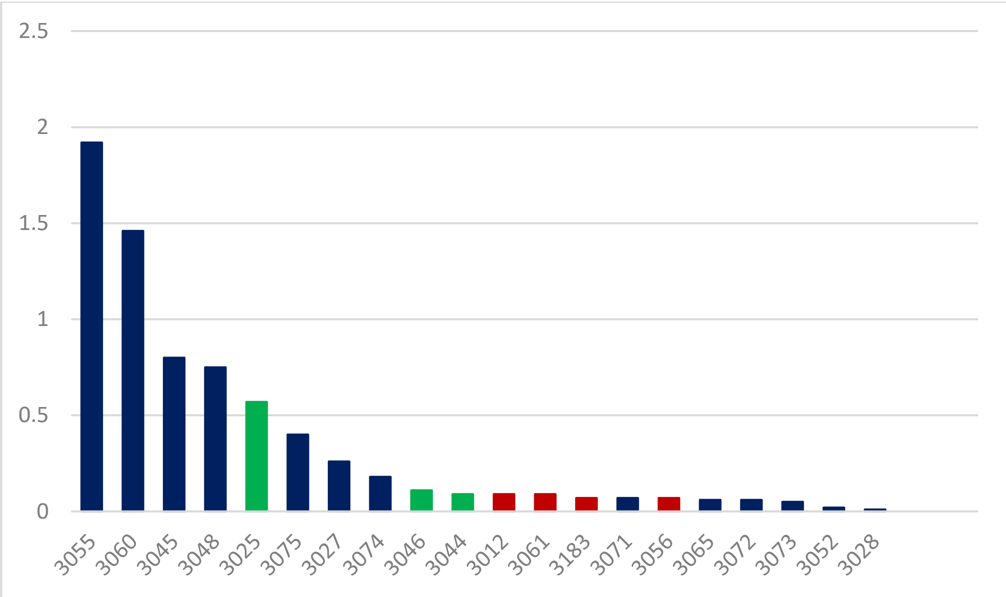


Figure 31: Sample preservation rate as whole grain to 2.0- and 1.0- mm cereal fragments ratio (y-axis). Categorised by SU (x-axis) and site location R1 (green), R2 (blue) and open areas (red).

Unlike diversity and density, the best preservation rates were found indoors. Certain units from Room 2 fared especially well with SU3055 having a ratio of 1.92 grains per fragment, and SU3060 at 1.46 seeds per fragment. These rates were not consistent, however, as the poorest performance was also in Room 2. SU3028, where 7 whole seeds were found in total, had a preservation rate of 0.01. This was also the case with SU3052 at 0.02 whole seeds per fragment.

Overall this is not a particularly high rate of preservation, which is consistent with the assessments made by eye in chapter three where 13 of 20 samples were rated significant to major contamination (see Table 5). These scores are interesting when considered in relation to the categories discussed in this chapter. In many cases, the contamination score is inconsistent with the other assessments.

Table 5: Modern contamination score of samples. Highlighted in red are SUs thought to have significant to major contamination but which rated in the top 4 in one of the criteria discussed above.

1. Minor Contamination	2. Medium Contamination	3. Significant Contamination	4. Major Contamination
3012	3045	3027	3028
3025	3048	3052	3060
3044	3071	3055	3061
3046		3056	3073
		3065	3074
		3072	3075
			3183

There does not seem to be a correlation between modern contamination and preservation. While SUs with a rating of significant to major do score poorly in preservation, there are distinct outliers. Furthermore, units with a minor to medium score perform just as poorly. This also applies to density levels where no distinct pattern is apparent.

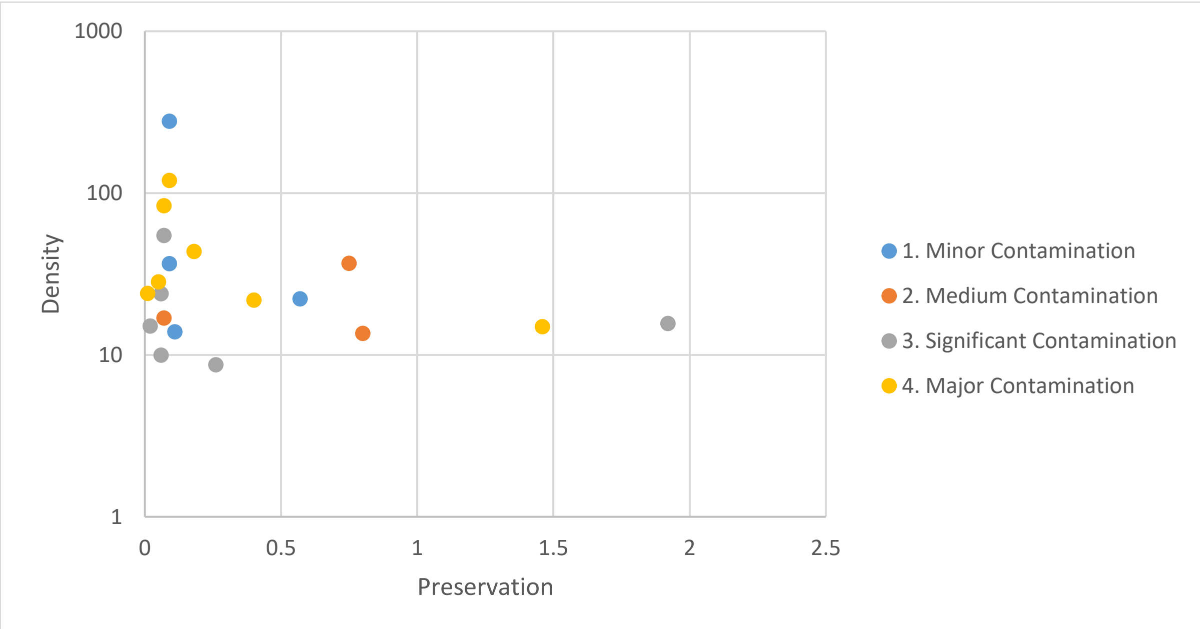


Figure 32: Comparison of preservation (x-axis) to density (y-axis) values for each sample grouped by contamination scores: 1. Blue. 2. Orange. 3. Grey 4. Yellow.

It is possible, as mentioned in chapter three, that sortation order negatively affected the overall impression of the sample. Alternatively, it could be that modern contamination played little role in the formation and survival of the deposits.

5.2 SU COMPOSITION

UBIQUITY

When studying the importance of a particular taxa in the assemblage, it is crucial to not only consider abundance but also its prevalence throughout the deposits studied. Ubiquity was calculated by counting how often a species appeared in the samples (see Figure 33). The most prevalent taxa were emmer and barley which were found in all twenty samples. Following this is *Lolium temulentum*, a species of particular interest. Poison darnel, as it is colloquially known, was present in 17 out of 20 units, making it the most ubiquitous weed of the assemblage. It often appears in proportional numbers to the cereal grains of a sample.

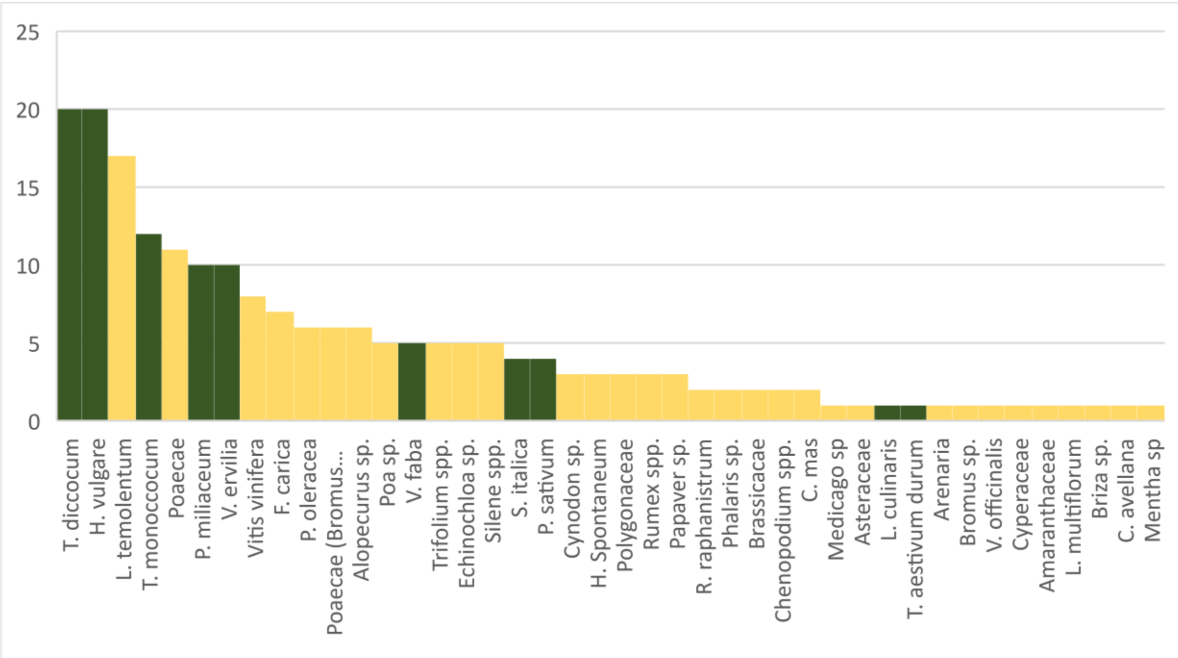


Figure 33: Species' ubiquity ranked by how often they appear in samples, coloured by staple crops (green) and wild plants (yellow).

Although einkorn was not as abundant as emmer, it was ubiquitous with remains found in 12 stratigraphic units. This was only slightly more than the other staple crops *Panicum* millet and bitter vetch which were counted in 10 units each. Bitter vetch was the most prevalent legume by far, existing in twice the number of SUs than the second most common legume, the broad bean. In comparison, the second millet variety *S. italica* was counted in only four units, the same number as the garden pea. The remaining staple crops, lentil and bread wheat, were only found in one sample each.

Two wild fruits had a frequency worth noting. Grape pips and fig seeds were found in 8 and 7 contexts respectively, suggesting that they were quite often present at the site.

PROPORTIONS

In the following section, ten units were chosen due to their abundance because anything smaller would not provide sufficient data for interpretation. To qualify each sample had to exceed 50 whole seeds and has been analysed in terms of assemblage proportions and overall characteristics. The samples considered are SU 3012, 3025, 3027, 3044, 3055, 3056, 3060, 3061, 3074, and 3183.

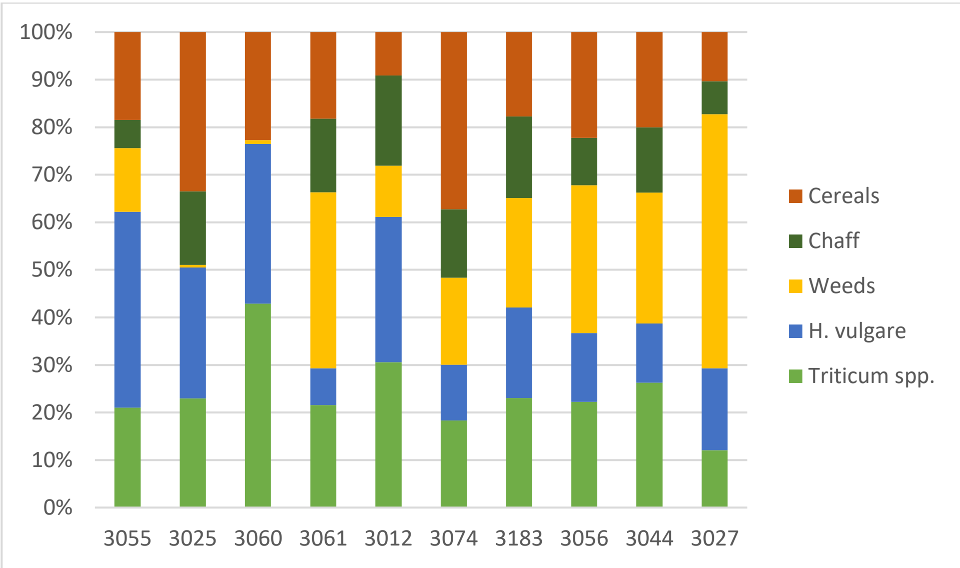


Figure 34: Proportions of chaff (dark green), weeds (yellow) and whole grains of H. vulgare (blue) and Triticum spp. *(blue) and remaining cereals comprised of millet and unidentified large grains (orange) from the 10 most abundant samples.*

In general, the samples analysed can be arranged into two assemblage categories: weed rich and crop rich[20]. A third category, chaff rich, was considered but discounted as no such samples were found. Overwhelmingly, the units are dominated by crops.

SU3060 and 3055 are the base and cover of the firepit in Room 2. Measuring approximately 1 metre in diameter[21], 3060 has a unique composition with no chaff found at all. The deposit rates high in terms of preservation, however, it is demonstrably low in diversity and density. The assemblage of these SUs strongly suggests a very clean crop. Only two non-cereal species were discovered inside the firepit: cornelian cherry and bitter vetch. Similarly, the cover of SU3055 features very little chaff, legumes and the only other cornelian cherry remains found. Although a percentage of weeds were recovered, these were *Lolium* and one *Bromus*-like Poaceae, large grains with a similar appearance to cereals. Weeds such as these would not be separated through winnowing and would require separation by hand, thus their presence in the assemblage was likely missed during processing.

[20] In which crop or weed constitutes more than 50% of the sample
[21] See Appendix 1 for SU sizes.

Aside from the firepit, three other samples can be considered especially crop rich; SU3012, 3025 and 3074. These samples stem from various parts of the complex and each feature a higher level of chaff than those from the Room 2 hearth.

SU3012 is the collapse of the perimeter wall to the north of Area D. It is a broad layer, approximately 3 x 4 metres and the densest sample analysed. However, only 4 litres of sediment were recovered, and it is unclear whether this was proportional or from a specific concentration within the unit. It is not a particularly diverse deposit but it was rich in cereals and cereal fragments in particular. It is worth noting that where other samples rich in cereals tend to have a corresponding amount of *Lolium*, only 3 seeds were found in this unit.

SU3025 is a consistently middling deposit from Room 1, located on the other side of the wall to 3012. Similar to the hearth remains, the weeds found in this assemblage were almost exclusively large grain types easily mistaken for crops. To a lesser degree this also applies to SU3074 from the northernmost corner of Room 2 where a strong concentration of millet was found.

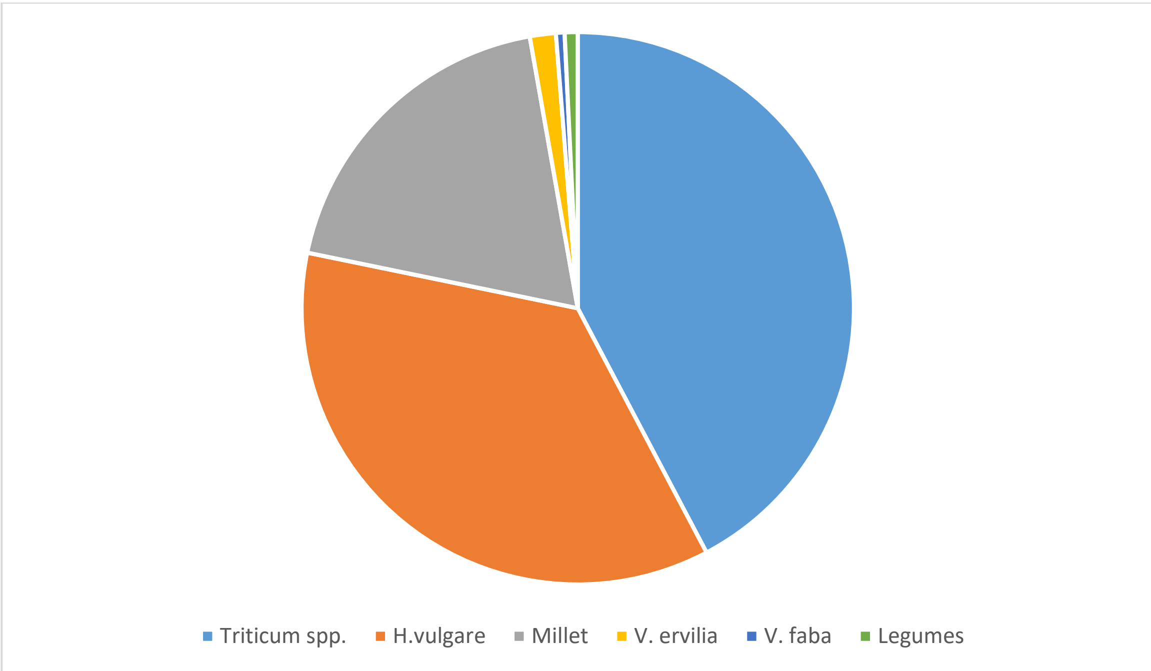


Figure 35: Proportional chart of staple crops from 10 most abundant samples, including Triticum spp. *i.e. T. dicoccon, T. monococcum, and Triticum* sp *(dark blue); H. vulgare (orange); Millet i.e. S.italica, P.miliaceum and NID (grey); V. ervilia (yellow); V.faba (light blue); and other legumes i.e. L.culinaris and P.sativum (Green).*

SU3061 and 3056 are located in close proximity to one another. SU3061, a layer directly outside of the western limit of Room 2, is the most diverse unit analysed and one of the densest. Emmer and poison darnel appeared here in remarkably high numbers at 47 and 98 grains respectively[22]. SU3056 is the semi-circular hearth to the West of the complex (see Figure 28). Like SU3061, it has a high

[22] Average *T. dicoccon* per sample = 9.74
Average *L. temulentum* per sample = 9.68

diversity and density rate with low preservation. This unit has a *Panicum* millet concentration and the most legumes found in any one context albeit a low number. In comparison to the units already discussed, these samples have a larger variety of weed sizes, suggesting that no winnowing has taken place.

SU3044 is located in Room 1 and has a similar composition to the outside hearth of SU3056. The same number of legumes was found here as well as several smaller and larger sized weeds. Like the other SUs discussed, this one is rich in staple crops with minimal chaff present, as is also the case for the final crop rich sample SU3183.

SU3183 is located at the southernmost corner of Area D. It shares a similar profile to SU3061 and SU3056 with poor preservation rates but high diversity and density. It also features an abundance of weeds of all sizes, however staple crops ultimately constitute 60% of the recovered sample.

Only one SU can be classified as weed rich. SU3027 fills a cut through Room 2 and is the least abundant unit selected for proportional analysis with only 61 seeds. Weeds, mostly *Lolium*, account for 50% of this assemblage. However, closer inspection of the weeds' sizes shows that 84% are larger, meaning that even here crop processing cannot entirely be discounted.

Chapter VI: Conclusion

An image is formed of the Area D settlement during the Archaic period by the formation process and plant composition of the assemblage established in the previous chapter. With the information gathered, it is possible to trace the point of entry of the charred remains into the archaeological record of this complex. With this process established, in the following chapter an outline will be made of the its implications on the agricultural methods of the compound and the concomitant organisation of labour. Consequently, it becomes possible to outline the overall economic profile of the site and by extension how Area D's settlement compared to the rest of Gabii and central Italy in this period in terms of agricultural practices and economic organisation.

The outstanding pattern in the SU formation came in the distribution of density and diversity values. Open areas of the site consistently rated higher while deposits inside Rooms 1 and 2 had similar values in both categories. In contrast, the higher rates of preservation occur indoors. Taking into account the depositional context, it becomes apparent that the refuse sources from indoors and outdoors were different. Likely, the open area deposits are refuse from the outdoor hearth, whereas the indoor refuse stems from disposal from the Room 2 firepit. The most diverse and highly abundant sample was found directly next to the hearth in an ashy sediment, suggesting it contains direct disposal from the fire. The remaining open area SUs are all located near wall limits, which have been found to be points of tertiary refuse accumulation as a result of surface activity such as cleaning, drainage and pedestrian activity (Fuller et al, 2014), explaining the higher density rates. This harsher exposure prior to burial, would naturally lead to comparatively more damage as seen by the much poorer preservation rates of the open area SUs.

In contrast, the similar profiles of Rooms 1 and 2 do not suggest any difference in indoor activity. The lower plant diversity of the indoor hearth, particularly within the firepit suggests that these assemblages stem potentially from cooking refuse, certainly from a later stage of crop processing than the much more diverse outdoor deposits.

Overall, the majority of samples analysed in this thesis are grain rich assemblages. Though chaff and weeds are present, they are small in numbers with the majority of weeds being large ones that are not easily separated from cereal grains.

It has been theorised that grains in the Area D complex were stored as semi-clean spikelets *i.e.* within their chaff (Cullen, 2016; Evans et al, 2019). Storage in such a method is expected to yield chaff-rich primary deposits with low numbers of weeds (Stevens, 2003). This interpretation cannot be confirmed by tertiary refuse deposits, however, the processing of semi-clean spikelets prior to consumption would likely produce a large amount of chaff refuse which in this case is absent. At this point, it must first be considered whether the cleaner indoor crop found in the studied assemblage is a result of compromised preservation. As suggested by Stevens (2003) prolonged exposure on the surface even indoors would disproportionately affected chaff due to its fragile nature. However, the scarcity seems to be authentic as the better preserved SUs and those with higher numbers of chaff are independent of one another.

This suggests that a certain degree of crop processing *e.g.* threshing and winnowing, had already taken place prior to the grains' arrival to the studied parts of the compound. These processes could have occurred off-site or in another area of the complex, however, it seems likely that a sieving phase occurred on site and the waste was disposed of in the fire pit outdoors.

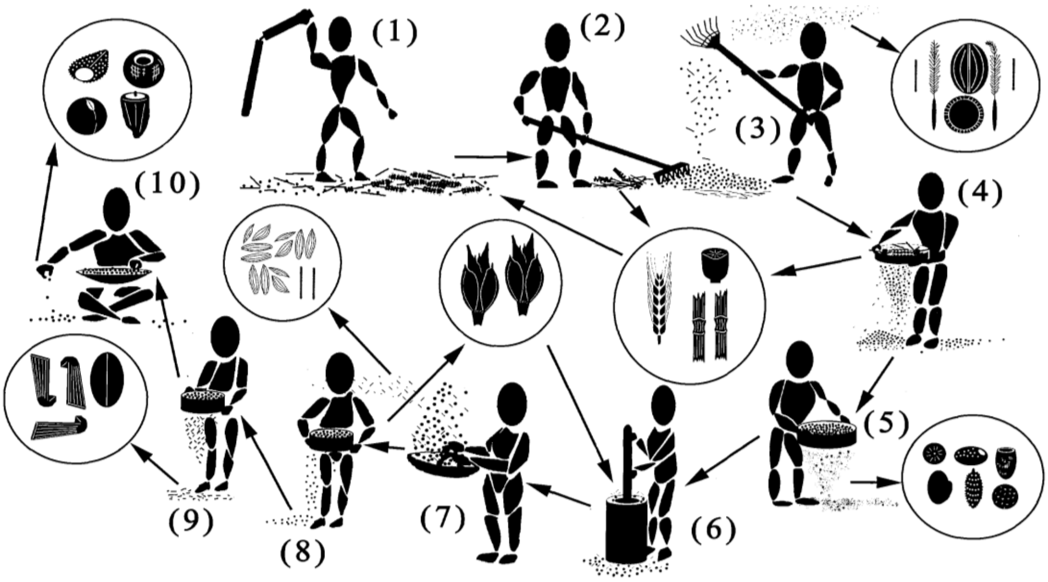


Figure 1. Processing stages for hulled wheats. (1) threshing (2) raking (3) 1st winnowing – light weed seeds, some awns removed (4) coarse sieving – weed seed heads, unbroken ears, straw fragments removed – unbroken ears re-threshed (5) 1st fine sieving – small weed seeds and awns removed (6) pounding (7) 2nd winnowing – paleas, lemmas and some awns removed (8) sieving with medium-coarse sieve – spikelet forks and unbroken spikelets – re-pounded (9) 2nd fine sieving – glume bases, awns, remaining small weed seeds, tail grain and awns removed (10) hand sorting – removal of grain-sized weeds by hand.

Figure 36: Crop processing stages as illustrated by Stevens (2003) depicting crop processing stages and plant parts removed. Crops stored as semi-clean have been processed up to stage 8.

This organisation of storage and refuse disposal, speaks to the availability and demand of labour at the complex and the hinterlands. Crop harvests are limited by time and weather constraints, therefore, the extent of processing that is done within this small window and what is relegated to day to day tasks is testament to how much man-power can be spared. The fact that the bulk of crop-processing occured prior to the crops arrival at the complex, suggests that the expenses and bodies could be spared. As it is, this comes as no surprise when one considers the economic and social status of the complex.

As for the range of crops available, though it seems limited at first glance in relation to the wealth of the compound, it is anything but. In order to fully comprehend this, however, it is important to discuss how the assemblage compares to contemporary sites in the area. Four locations are considered, two of which are in Gabii: the contemporary Area A elite complex excavated simultaneously to Area D by the GPR (Motta et al, forthcoming), the Regia complex of the Gabii Acropolis excavated by the Soprintendenza (Cullen, 2016). Further afield, archaeobotanical finds from the settlement on the Palatine Hill in Rome are considered (Motta, 2002) and from the Etruscan sanctuary in Sant'Antonio, Cerveteri (Izzet, 2002). Further attention is also given to other sites across the Italian peninsula with reference to specific plant remains (Garnsey, 1999; Marvelli et al, 2013).

In many ways, the profile of the samples analysed in this thesis match those previously recovered from Area A and the Regia complex. Barley and bitter vetch have consistently been present as a major crop throughout the entire site. Millet, while hardly ever present in either other locations, exists in Area D. This is also the case for *Lolium,* which is pervasive not only at Gabii but also Rome (Motta, 2002). The presence of grape in the assemblage also suggests exploitation which was occurring to varying degrees over the entire Italian peninsula (Marvelli et al, 2013). Occasions of cornelian cherry exploitation are also seen in San Lorenzo a Greve, Florence and Terramara of Montale, Modena during the Middle Bronze Age, however little work has been done on its continued role throughout the Iron Age (Accorsi, 2004 cited in Marvelli et al, 2013). Some crops such as naked wheat, peas and lentils were found in minimal numbers. These are known staples of the Mediterranean diet in Antiquity (Garnsey 1999), however in archaeobotanical studies of central Italy specifically, they are found in small numbers in Rome (Motta, 2002) and Cerveteri (Izzet, 2000) during the 6th century BCE.

The differences between the current assemblage and those previously studied at Gabii occur in the prevalence of emmer. During the Archaic period of Area A, emmer was found to be more than twice as abundant as barley. In contrast, at the Regia complex, it was found to be a secondary crop at best due to its lower frequency (Cullen, 2016). Here, emmer appears to be as ubiquitous as barley though not as abundant[23]. This could be due to methodological or taphonomic constraints, however, it does support the overall profile of the city. The presence of emmer as the dominant staple crop is much more common to Roman sites, such as the Palatine Hill where 6th century BCE archaeobotanical remains showed emmer outnumbering barley almost 2:1 (Motta, 2002)[24]. Emmer also seems to have been the preferred cereal in contemporary Etruscan sites such as Cerveteri (Izzet, 2002). The proximity of these sites to one another and the persistent presence of emmer and barley to varying degrees shows that the plants were readily available at each. Once geographic constraints are discounted, it is likely that cultural preference caused a community to choose one over the other. In Gabii, these preferences appear to have even occurred on a complex to complex basis.

Similar cultural preferences can be seen in legume selections. In Rome, literary sources seem to show a clear predilection for broad beans, as is supported by archaeobotanical finds from the Palatine Hill (Motta, 2002) and from Ceveteri (Izzet, 2000). Though broad beans were also present in this assemblage and previous ones studied at Gabii (Cullen 2016; Evans et al, 2019), they are consistently outnumbered by bitter vetch. In addition, broad beans seem to have significantly declined in use. Where in the Acropolis they were found present in 42% of the samples (Cullen, 2016), for this assemblage they featured less often and in much fewer numbers[25]. In contrast, bitter

[23] Emmer has a 100% ubiquity but is outnumbered by barley 1.5: 1.
[24] Figure includes grains classified "cf". Definitive ratio is 1.3:1.
[25] *V.faba* found in 25% of samples studied

vetch abundance and ubiquity has remained consistent. As a result, the common belief that bitter vetch is used exclusively as fodder has been brought into question. The results of this thesis are consistent with the argument that bitter vetch was used as a food source. Bitter vetch is consistently found in grain rich assemblages that were most likely intended for human consumption. Furthermore, though there are plenty of signs of animal consumption, no signs of a stable have thus far been found on the complex, discouraging the idea that a large fodder source would be needed.

It is necessary to reflect on the biases of modern and classical influence before applying it to physical evidence. Many of the literary sources used as reference for central Italian agriculture today were written several centuries after the period in question and have a tendency to focus predominantly on specialist crops (Murphy, 2015). This focus can, and has, easily been misconstrued as a lack of interest or exploitation of unmentioned plants. This is the case for bitter vetch, and even more so for millet. As stated in chapter four, millet is often dismissed as a low status or fodder crop, however it is present in the elite complex of Gabii.

The high economic status of the Area D complex is not in question. It is well established by the wealthy infant burials and artefacts discovered (Mogetta and Becker, 2014; Evans et al, 2019). The idea that the plant profile retrieved from it represents an economically poor diet is therefore another potential case of modern misconception. Two assumptions must be made to reach such a conclusion: the first is that the carbonised remains are wholly reflective of all foods consumed in the complex; and the second is that the dietary compositions of elite and peasant residences were mutually exclusive.

As a tertiary mixed deposit, the archaeobotanical remains studied in this thesis represent only what was not consumed and likely only plants which were processed on a regular basis over an extended period of time. Most importantly, it represents exclusively that which was carbonised. It is not unreasonable to assume that the reality of the Area D diet was much more diverse, especially as glimpses are given by the occasional discovery of less common species such as the lentils, cherries, hazelnuts and grapes found in this assemblage.

The division of crops into low and high status creates a dichotomy where crops such as barley, bitter vetch and millet are only eaten out of necessity rather than choice[26]. It has been established above that the more common consumption of barley and bitter vetch over emmer and broad beans was a choice not a constraint. This is likely also the case for millet. Therefore, it should be considered whether the definition of a low status diet should not come from the consumption of such plants but a reliance thereupon. This theory has also been considered in the later consumption of millet in the Imperial period by Murphy (2015) who found that millet was pervasive throughout the elite residences of Pompeii. Similarly, evidence shows that broad beans, which could be considered a low status crop in Imperial Rome, were consumed by the elite and all that differed was the manner in which they were consumed (Corbier, 2000).

[26] Even the broad bean has been referred to in Imperial Roman sources as a "worker's" food by 1st century CE satirical writer Martial (Epigraphs Book 13)

Much remains to be explored in terms of archaeobotany from this phase of occupation in Area D. Foremost, a synthesis of the work already completed would be prudent in revealing a bigger picture of the plant assemblage present. Preliminary work is being conducted on the plant remains recovered from Area C which, as part of the same complex, stands to provide more information on the activities which occurred (Gavériaux, forthcoming). Further information could also be attained from the analysis of the carbon fragments recovered from the samples. This could potentially provide further insight on the arboreal taxa exploited by the settlement in terms of diet and architecture and several other uses. Consideration can also be given to the currently unknown items, some of which are potentially signs of food preparation remains.

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Appendix

Sample list of SUs with soil sample weight, formation processes and size (l x w) in metres. Size taken from SU context sheet or estimated from map scale when no measurements were available. Estimated sizes marked "ca." SU3060 was circular, diameter calculated.

GPR11 AREA D	**SOIL SAMPLE (L)**	**FORMATION PROCESS**	**SIZE (m)**
SU 3012	4	Collapse	ca. 2 x 3
SU 3025	24	Accumulation	2.6 x 1.2
SU 3027	18	Accumulation	5.9 x 2.9
SU 3028	13	Accumulation	7 x 2.4
SU 3044	16	Accumulation	ca. 3 x 4
SU 3045	16	Accumulation	3.8 x 3.8
SU 3046	16	Accumulation	ca. 1 x 1
SU 3048	14	Accumulation	ca. 2 x 2
SU 3052	18	Accumulation	ca. 2 x 2
SU 3055	14	Accumulation	ca. 3 x 2
SU 3056	16	Collapse	2.6 x 2.2
SU 3060	14	Collapse	ca. 1
SU 3061	16	Accumulation	ca. 1 x 3
SU 3065	14	Accumulation	6.3 x 5.4
SU 3071	17	Accumulation	1.3 x 1
SU 3072	21	Accumulation	1.1 x 1.1
SU 3073	16	Accumulation	3.2 x 1.2
SU 3074	18	Accumulation	2.8 x 2.5
SU 3075	16	Accumulation	3.5 x 1.1
GPR12 AREA D	-	-	-
SU 3183	19	Accumulation	2 x 1.5